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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Office of Pesticide Programs, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

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74-2270. Johnson, J. E.; Blair, E. H. (Dow Chem. Co., Midland, MI). **Cost, time and pesticide safety.** *Chem. Technol. 2(11): 666-669; 1973.*

The R and D costs in 1956 for the development of a new agricultural chemical were $1,196,000 (not including pilot plants, process development and such studies as waste controls and environmental factors.) By 1964, the cost had doubled, and by 1969, it had tripled. The authors estimate that today, one new pesticide emerges for every 10,000 compounds tested; the time from discovery to market is 8-10 years, and the cost is greater than 10 million dollars. A "winner" is a project that lasts on the market for 9 years or more at an annual sales of $10-20 million, and a pre-tax return on investment of 40%. But the winners must support the "losers," each of which can cost from half a million dollars to $4.4 million, depending on the stage at which the project is abandoned. A rapidly increasing aspect of pesticide R and D is safety: toxicology, metabolism, analytical, and ecology studies. The safety evaluation minimum registration requirements for a chemical have greatly increased since 1950; the authors expect additional safety requirements soon, and fear that the "losers," having to be abandoned at yet a later stage, may cost the company or its stockholders many more millions of dollars.

74-2271. Bazzi, B. (Author address not given). **La ricera scientifica di fronte alla contaminazione dell'ambiente da antiparassitari--contributo allo studio del problema. [Scientific research on environmental pollution by pesticides: Contribution to the study of this problem.]** *Contrib. Ist. Ric. Agr. (Milan) 11:37-42; 1972.* (29 references) (Italian)

The widespread of use of pesticides and considerations on pesticide toxicology necessitate studying ways to avoid ecological, agronomical, and health problems. Studies done by Montecatini Edison Agricultural Research Institute revealed that a new pesticide is needed with a lower toxicity than DDT and its metabolites, capable of being chemically and biologically degraded and metabolized. Methods for detection of pesticide residues should be made more accurate and safety standards and tolerances set up and followed.

74-2272. Hurtig, H. (Res. Br., Canada Dept. Agr., Ottawa, Ontario, Canada). **Significance of conversion products and metabolites of pesticides in the environment.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1971, p. 58-78.* (55 references)

In order to effectively plan for the future of the environment it is necessary to study the behavior and persistence of pesticide residues, the acceptability of residues, the acceptable daily intake, alteration of biochemical functions by pesticides, and potentiation effects. Absorption, storage, excretion, penetration, metabolism, mode of action, degradation, chemical properties, and comparative enzymology of pesticides must be studied. Cooperation among all disciplines regarding accumulation of pesticides in food chains is needed. Studies have been performed in model ecosystems and indicated the unpredictable nature of these chemicals. Current studies have shown that food chain accumulation is also likely for organophosphorus compounds which are viewed as a substitute for organochlorines. Previous experiences with DDT, mercury, and some cyclodiene insecticides will aid in establishing environmental acceptability of replacements.

74-2273. Van Tiel, N. (Plant Protection Serv., Wageningen, The Netherlands). **Pesticides in environment and food.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 180-189.* (12 references)

Side effects of pesticides appear in the abiotic and biotic environment, are not always predictable, and include the development of resistance, effects on the interaction between plant and animal life, and the presence of residues in food and subsequent intake. Pesticide residues are defined as unpredictable and undesirable remainders of chemical treatment of an agricultural product. These residues occur in food not always as a result of trying to protect the food against pest attack: soil may have been previously contaminated by foliar treatment of earlier crops in rotation; animal products may have residues as a result of animals' feeding on contaminated fodder crops; residues may arise from a chemical occurring in the environment. The tolerance is defined as the maximum concentration of pesticide residue permitted on or in food at a specified stage in the harvesting, storage, transport, marketing, or preparation of the food. Intake of pesticides must be figured from total diet studies.

74-2274. Hurtig, H. (Canada Dept. Agr., Environmental Quality Res., Ottawa, Ontario, Canada). **Current pressing problems raised by pesticides and their conversion products in the environment.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 209-216.*

Use of pesticides on recreational areas and in homes and gardens is a large problem. Restrictions on chemicals available to the homeowner and backyard gardener may help the situation. As newer production technologies come into play on farming areas, the demand for chemicals intensifies. There is an apparent lack of communication between scientists and legislators, between scientists and the general public, and between scientists of varying disciplines regarding pesticide hazards which must be overcome. Controls are needed in the area of fungicides,and a total balance must be achieved concerning all chemicals used in the fields. In Japan, soils have been polluted through the use of

new pesticides before their metabolism was fully understood. Detoxification of these soils is now a problem. Organomercury fungicides had been used for rice plant protection in Japan; however, due to chronic toxicities, this use was stopped in 1968 at which time BHC was the most heavily used organochlorine pesticide. The main residual component in soils, rice straw, and cows' milk was β-BHC. The production and application of BHC in Japan was eventually stopped. Organophosphate and carbamate compounds are now recommended for plant protection in Japan.

74-2275. Anonymous. **Recommendations of the second international symposium "chemical and toxicological aspects of environmental quality".** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/ Academic Press, Stuttgart/New York, 1972, p. 252-257.*

The purpose of the symposium was to discuss environmental quality as affected by technology and the biological-toxicological and financial consequences. It was not possible to obtain a survey of the products in use and their fields of application until recently; it was noted that more and better ways are available for cleaning the air than for cleaning water. Studies were recommended on residues of products introduced intentionally or unintentionally into the environment and their fate under environmental conditions. The extent of ecological-toxicological research on the evaluation of effects of significant pollutants on man and his environment was reviewed. Results of ecological-toxicological investigations with certain insecticides were presented. Teratogenic effects of 2,4,5-T were noted. The discussion of the accumulation of residues in food chains revealed that the accumulation factors can vary considerably in different species.

74-2276. Behrens, L. B. (Author address not given). **Pesticides: two views.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(5):1551-1553; 1973.*

Because of legislative limitations on the use of pesticides such as DDT, TDE, aldrin, and dieldrin, new methods of pest control are receiving considerable attention. Among the new pesticides are DDT analogs, which are considerably less toxic than DDT, as well as less persistent, being biodegradable. When they break down, however, they leave an aromatic ring, the effects of which on living organisms are not fully understood. Additional new methods of pest control include microbial pesticides (bacteria and viruses) and larger living organisms (protozoa and nematodes). The use of DDT analogs will spare some insect pests, but will also spare their predators. Viruses may constitute the best means of pest control currently being tested. The most promising insect viruses are nuclear polyhedrosis viruses from the alfalfa looper and granulosis viruses of the same group. The virus offers no risk to human or plant health or the environment, and no chemical by-products are associated with their use. Study of cholinesterase may lead to making slight structural changes in organophosphates to turn them into selective pesticides. The interest of foreign countries indicates improving prospects for worldwide acceptance of new pest control methods.

74-2277. Hoskin, F. C. G. (Illinois Inst. Technol., Chicago, IL 60616). **Pesticides.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32: 2077; 1973.*

In the article entitled "Pesticides: Two Views" (see Abstract No. 74-2276) the chlorinated hydrocarbon pesticides and the cholinesterase inhibitor type insecticides were lumped together. These two groups are fundamentally different from both a chemical and a biological point of view. Numerous organophosphates and carbamates have effects on cells which are not exclusively related to their cholinesterase inhibiting properties. A more serious flaw seems to relate the cholinesterases to DDT. Some of the faults in the article appear to result from the present trend away from fundamental knowledge and toward relevance and applications.

74-2278. Anonymous. **Fluoroacetate toxicity.** *Fluoride 6(3): 187-188; 1973.* (3 references)

Fluoroacetate and its salts are among the most toxic organic fluorides. The current issue of *Fluoride* features a symposium on toxicity of fluoroacetate. This editorial briefly describes the work of the authors, abstracts of whose papers appear in this journal. A vital question is the possibility that minute amounts of fluoroacetate might be present in the human organism through conversion from inorganic fluoride or through ingestion of food containing the toxic agent. The presence of fluoride in forage plants and fluorocitrate in lettuce and fluorosed bones of cattle has been demonstrated. There is evidence for fluoroorganic compounds in heart and kidneys of cattle and horses with skeltal fluorosis.

74-2279. Ruge, W.; Valentin, F. (D-3000 Hanover, Boedeckerstrasse 12, Germany). **Einfuehrung zum Thema. [Introduction.]** *Internist (Berlin) 14: 189-190; 1973.* (6 references) (German)

Introductory remarks on different topics dealing with health aspects of environmental hazards, such as air and water pollution, noise, and pesticide residues are presented. Pesticide residues in meat, dairy products, and foods of vegetable origin are a major concern of medicine and toxicological research. Complex teamwork of medical research and practice will be required for the elaboration of a set of evidence on which to base environmental protection measures.

74-2280. Shindo, N. (Tokyo Organic Chemical Ind. Ltd., Tokyo, Japan). **[The present situation of organo-**

phosphorus pesticides in Japan (1).] *Jap. Pestic. Inform. 17:17-21; 1974.*

There has been a marked increase in the use of agricultural chemicals in Japan in recent years. The organophosphorus group of pesticides makes up 20-25 per cent of the total bulk of chemicals being used. In 1970, nearly 14,300 tons of organophosphorus compounds were consumed, and among these were 12,000 tons of materials produced domestically. There were 2,300 tons of imported materials.

74-2281. Shindo, N. (Tokyo Organic Chemical Ind., Ltd. Tokyo, Japan). **[The present situation of organophosphorus pesticides in Japan (2).]** *Jap. Pestic. Inform. 18:16-21; 1974.* (Japanese)

Organophosphorus pesticides occupy more than half of the total bulk of all exported agricultural chemicals. The most important compounds exported were fenitrothion, malathion, leptophos, dichlorvos, and phenthoate. Among those organophosphorus pesticides imported in Japan were fenthion, thiometon, and diazinon. In listing organophosphorus pesticides according to use 38 per cent are fungicides, 34 per cent are insecticides, 13 per cent are insecticide-fungicides, and 4.4 per cent are herbicides.

74-2282. Makepeace, R. J. (Author address not given). **Herbicides.** *J. Roy. Agr. Soc. Engl. 134: 114-125; 1973.* (95 references)

On the list of approved products for farmers and growers published by the British Ministry of Agriculture, Fisheries and Food) there were 459 separate herbicide products listed in 1973, as compared to 104 in 1958. Increased competition between suppliers has led to stable prices. Selection and proper use of herbicides has become more complicated. This review contains lists of currently approved herbicides for various crops. Eighty five percent of the cereal acres, or 6.87 million acres in England and Wales, is sprayed annually with hormone-based broad-leaf weed killers. In the last five years there has been a swing to broad-spectrum herbicides, especially those based on dicamba.

74-2283. Saha, J. G. (Canada Department of Agriculture, Research Station, University Campus, Saskatoon, Saskatchewan, Canada). **Significance of mercury in the environment: suggestions for further research.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 81-86.*

A review of levels of mercury in various natural and artificial sources is given. Mercurial seed dressings were used at the rate of 1 g Hg/acre or less, which was of the same order of magnitude which the soil receives through precipitation, thus adding an insignificant amount to background mercury levels. The importance and difficulty of accurately establishing background levels of mercury is discussed. Various methods are suggested, including comparison of mercury levels in fish collected decades ago and preserved in museums and with the levels in fish of the same species collected recently from the same body of water.

74-2284. Ionescu, M. (Inst. Agron. "Nicolae Balcescu", Bucharest, Rumania). **Pesticidele substante chimice de combatere a daunatorilor agricoli si de poluare a mediului si a materiilor alimentare. [Pesticides: Chemicals used to control agricultural pests: environmental pollutants and food contaminants.]** *Stud. Cercet. Chem. 21(2): 161-181; 1972.* (Rumanian)

Chemicals provide a high efficiency in agriculture but a concomitant danger through incorrect use. The use of pesticides should be reduced, or restricted to dangerous effects on humans, animals, and the environment in gneeral. The concentration of pesticides in air, water, and soil should be controlled. Pesticides used should be studied and the treatment necessary in case of poisoning should be known. Pesticides can be replaced with other alternative means of control. Improper use of insecticides can intoxicate humans and animals and cause nutritional disturbances. When pesticides do not act in the intended way resistance to their effects is explained by the formation of an enzymatic system inside the organism.

74-2285. Van Raalte, H. G. S. (Shell Int. Res. Co., The Hague, The Netherlands). **Chemical pollution and the fauna, its implications for industrial research.** *TNO-Nieuws 27(10): 627-630; 1972.* (4 references)

Eighty to 90% of all insect problems are controlled by conventional insecticides, some of which are undesirable because they persist in the environment, are not easily biodegradable in animals, and kill too wide a variety of insects. Approval to use a newly developed insecticide in the Netherlands is reconsidered by national authorities at regular intervals. Since the fifties, sensitivity of chemical detection methods has increased a million-fold. But as pesticide development progresses, industry must develop new sensitive and specific methods for detection of chemicals in biotic and abiotic material. At the laboratory level, once movements of a pesticide through the environment are understood, residue levels at appropriate sites and in indicator species should be determined but this has very limited predictive value. When identification of breakdown products and methods of analysis have been achieved, there must be a scale-up to field trials. However, reliable data can only be obtained after the compound has been in use many years in large amounts and has relatively stable degradation products. Monitoring at distant sites should be done by government or independent institutes in collaboration with industry. In cases of pesticide poisoning, the time, place and formulation may be responsible instead of the chemical per se and industry must try to change those factors to ones less harmful. If this is impossible, withdrawal of their use should be considered.

74-2286. Grocki, D. R. J.; Johnston, D. W. (Dept. of Zoology, Univ. of Florida, Gainesville, FL 32611). **Chlorinated hydrocarbon pesticides in North American cuckoos.** *Auk 91(1): 186-188; 1974.* (3 references)

Chlorinated hydrocarbon burdens were determined in 16 yellow-billed (*Coccyzus americanus*) and one black-billed (*C. erythropthalmus*) cuckoo from Florida. The means for all autumn yellow-billed cuckoos of average weight 78.8 g and 68.6% lipid in adipose tissue were 0.54 (ppm lipid weight) *p,p'*-DDE, 0.05 *p,p'*-TDE, 0.53 *p,p'*-DDT, and 0.04 dieldrin. For spring yellow-billed cuckoos of average weight 53.6 g and 57.8% lipid in adipose tissue corresponding figures were 0.36, 0.03, 0.03, 0.01. For the black-billed cuckoo, an autumn bird of 67.8 g and 85.3% lipid in adipose tissue, corresponding figures were 0.12, 0.04, 0.12, and 0.04.

74-2287. Johnson, J. L.; Stalling, D. L.; Hogan, J. W. (Fish-Pesticide Res. Lab., Bureau Sport Fisheries Wildlife, Columbia, MO 65201). **Hexachlorobenzene (HCB) residues in fish.** *Bull. Environ. Contam. Toxicol. 11(5): 393-398; 1974.* (16 references)

The HCB residues in various species of freshwater and anadromous fish, fish eggs, fish fry, and fish oil from widely scattered areas in the United States were determined by GC-MS identification, silicic acid column separation, and gas-liquid chromatographic (GLC) analysis. HCB residues were found in many species of fish and in the fish eggs, fish fry, and fish oil. In general, the HCB concentrations in the fish were comparable to those reported for fish in Europe and Canada, but in some cases the U.S. fish had much higher HCB levels. In one instance, the source of HCB was identified as runoff from a chemical storage area; otherwise, the sources of HCB residues were not known. The potential significance of HCB residues in fish and fish products should not be underestimated.

74-2288. Thompson, N. P.; Rankin, P. W.; Johnston, D. W. (Pesticide Res. Lab., Dept. Food Sci., Univ. Florida, Gainesville, FL 32601). **Polychlorinated biphenyls and *p,p'*-DDE in green turtle eggs from Ascension Island, South Atlantic Ocean.** *Bull. Environ. Contam. Toxicol. 11(5): 399-406; 1974.* (14 references)

Ten green turtle (*Chelonia mydas*) eggs taken from Ascension Island in the South Atlantic Ocean were analyzed by gas chromatography for residues of DDT, DDD (TDE), DDE, and PCBs. Multiple PCBs were found, as were *p,p'*-DDE, DDD, and DDT. Ascension Island is geographically isolated, has no streams, and houses a small, generally transitory human populaton. No PCBs are produced there or released into surrounding waters, and only inconsequential amounts of organochlorine pesticides are occasionally used. Since the green turtle feeds on marine plants supplemented by some invertebrate animal food, the female turtles laying the eggs on Ascension Island must have ingested the PCBs and DDT metabolites via organisms eaten en route from the principal feeding grounds off the eastern coast of Brazil to the breeding beaches on Ascension. None of these marine environments constitutes an area of high industrial pollution. The residues found in the green turtle eggs did not seem to dramatically decrease the hatching success or increase the occurrence of deformed hatchlings.

74-2289. Ware, G. W.; Estesen, B.; Cahill, W. P. (Dept. Entomol., Univ. Arizona, Tucson, AZ). **Dislodgeable leaf residues of insecticides on cotton.** *Bull. Environ. Contam. Toxicol. 11(5): 434-437; 1974.* (2 references)

Azodrin, methyl parathion, toxaphene-methyl parathion, parathion-methyl parathion, parathion, guthion, galecron, lannate, DDT, and encapsulated methyl parathion were applied to test plots of DPL-16 cotton. During the four days following treatment, triplicate leaf residue samples were collected from each plot to determine the easily removed surface residue levels. The rate of disappearance from initial deposit was lannate > methyl parathion > ethyl parathion > toxaphene-methyl parathion > guthion > encapsulated methyl parathion > DDT > azodrin. The galecron-treated plot did not show detectable residues at any time. Lannate residues were present at much lower levels than the other compounds.

74-2290. Derr, S. K. (Dept. Entomology-Pesticide Res. Cent., Michigan State University, East Lansing, MI). **Bioactive compounds in the aquatic environment. Loss of methoxychlor from autumn-shed leaves into the aquatic environment.** *Bull. Environ. Contam. Toxicol. 11(6): 500-503; 1974.* (4 references)

Since leaves shed into an aquatic environment serve as a source of food for many lotic fauna, autumn-shed leaves of oak, beech, and maple were collected and treated with methoxychlor to give a concentration of 10 ppm. Twenty leaves of each species were then placed in each of three 45-liter aquaria supplied with water from a continuous-flow dilution apparatus at a rate of 800 ml/min. Leaves were collected at intervals of 0, 5, 10, 15, and 20 days and analyzed for residues. Methoxychlor had a half-life of 7 days in beech as opposed to 26 and 24 days for maple and oak, respectively. Oak and maple did not differ in their capacity to eliminate methoxychlor. The differential loss of methoxychlor from these three species suggests that detrital input, in the form of autumn-shed leaves, into the lotic environment could serve as a partitioning reservoir for methoxychlor residue, which could then be incorporated into the aquatic community.

74-2291. Johnson, L. G.; Morris, R. L. (State Hygienic Lab. Univ. of Iowa, Iowa City, IA 52240). **Chlorinated insecticide residues in the eggs of some freshwater fish.**

Bull. Environ. Contam. Toxicol. 11(6): 503-510; 1974. (8 references)

Eggs of channel catfish, largemouth bass, walleye, and northern pike were collected from various locations in Iowa rivers and analyzed for organochlorines. Dieldrin was the major residue detected, with highest levels (900 ppb) found at the two locations where high concentrations in fish flesh and water samples had been previously reported. Polychlorinated biphenyls, DDE, TDE, and heptachlor epoxide, were detected in all samples, and aldrin, γ-chlordane, and α-chlordane in some. Residues are correlated with fish size and lipid content. Residues were generally below 200 ppb except in the two most highly contaminated rivers.

74-2292. Dacre, J. C. (Laboratory of Environmental Medicine, Tulane University School of Medicine, New Orleans, LA). **Residual organochlorine pesticides in the fat of mutton birds of New Zealand.** *Bull. Environ. Contam. Toxicol. 11(6): 517-522; 1974.* (13 references)

Fat samples from 6 adult and 1 chick mutton birds of New Zealand (*Puffinus griseus*) were analyzed for organochlorines. Mean levels for the 6 adult birds, in ppm wet weight, were *p,p'*-DDT 1.54, *p,p'*-DDE 13.50, *p,p'*-TDE 0.64, β-BHC 5.17, dieldrin 0.93, and polychlorinated biphenyls 1.83. Corresponding levels for the chick were 0.10, 1.30, 0.04, 5.02, 0.21, and 0.05. Hexachlorobenzene (HCB) was not detected. Continued use of these birds for food may be inadvisable because of the heavy contamination.

74-2293. De Vos, R. H.; Ten Noever de Brauw, M. C.; Olthof, P. D. A. (Central Inst. for Nutrition and Food Research TNO, Zeist, The Netherlands). **Residues of and related compounds in greenhouse soils.** *Bull. Environ. Contam. Toxicol. 11(6): 567-571; 1974.* (4 references)

Soil samples were collected at random, mainly from places in which pentachloronitrobenzene (PCNB) had been used as a fungicide. Soils were extracted and analysed by gas-liquid chromatography. Ten samples containing PCNB and several other peaks which were thought to be related to that compound were examined by a computer coupled mass-spectrometer/gas chromatography system. Compounds identified were pentachloronitrobenzene, pentachloroaniline (PCA), pentachlorothioanisole (PCTA), tetrachloronitrobenzene, tetrachloroaniline, tetrachlorothioanisole, hexachlorobenzene, and pentachlorobenzene. PCA residues were 15-150% of the PCNB residue present, PCTA residues were 10-90%.

74-2294. Finlayson, D. G.; MacCarthy, H. R. (Marine Ecology Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). **Pesticide residues in plants.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 57-86.* (166 references)

Pesticide residues may originate from accidental or incidental contamination as from spillage, adherence to soil, volatilization, or drifting of dusts and sprays in the wind. However, the largest source of residues is deliberate external or internal treatment. The possible biotransformations of pesticides in plants and soils include : oxidation, dehydrogenation and dehydrohalogenation, reduction, conjugation, hydrolytic reactions, exchange reactions and isomerization. The choice of pesticide is influenced by economic factors as well as longevity, formulation, type of pest, method of application, degree of isolation and climate. Residues are greatly influenced by the formation, method of application, soil conditions, weather, penetration, absorption, translocation and diffusion. Governmental agencies have established legal limits of permissible amounts of residues based on either the maximum amount that should exist when a chemical has been properly used, or not more than 1/100th of the minimum dose which will produce any physiological effect on the most sensitive of two or more species of lab animals for 2-4 lifetimes. The hazards to man are not completly understood. At greatest risk are the predators at or near the tops of food chains. These take in the accumulated residues held in the fatty tissue of their prey, which they then store. Tobacco, being neither a food nor a drug, is exempt from pesticide tolerance limits in the United States. Recent studies indicate that the pesticide intake of the one pack/day smoker through the mainstream of smoke nearly equals the daily intake in food. The usual method for limiting residues in agricultural produce is to specify a time interval in days which must elapse between last application and harvest, allowing for degradation of the pesticides. Storage and processing lower the amount of residues as well.

74-2295. Thompson, A. R. (Nat. Vegetable Res. Sta., Wellesbourne, England). **Pesticide residues in soil invertebrates.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 87-133.* (117 references)

Residues of insecticides differ greatly among forests, orchards, and fields used for crops. DDT and methoxychlor have been detected in earthworms sampled in forests, often in concentrations larger than in the surrounding soil. Analysis of earthworms from orchards indicates that these annelids can store residues of several organochlorine insecticides. Earthworms in soils with large residues contained larger residues than those in soil with small concentrations of insecticides, and species of earthworms living in deep burrows accumulate similar residues to those living in the surface layers of the soil. Residues in earthworms from arable land are smaller than those from forest or orchard soil. Residues in tissues of slugs are usually similar to and often larger than residues in earthworms from the same sites. Residues in slugs fluctuate with the season and the period between treatment and sampling. The uptake of insecticides into slugs is similar to that in earthworms.

Residues of organochlorine and organophosphorus insecticides can be very large in individuals on treated soils. Residues in beetles differ greatly from those in slugs in the same plots and illustrate the different abilities of beetles and slugs to store residues. Predatory beetles were killed more readily than earthworms and slugs by normal dosage of many insecticides. Metabolic pathways by which earthworms, slugs, and beetles degrade some of the insecticides are presented. Ecological consequences of residues of insecticides in soil invertebrates are considered, and areas for future research and control are suggested.

74-2296. Kerr, S. R.; Vass, W. P. (Marine Ecology Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). **Pesticide residues in aquatic invertebrates.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 134-180.* (165 references)

Amounts of residues of DDT and its derivatives and other organochlorine contaminants currently occurring in aquatic invertebrates are listed. The principal sources of the residues include initial translocation to water; translocation to the sea; events in the aquatic surface layer where the surface microenvironment supports a biologically active community which must serve to transfer pesticide residue to the biota of the underlying water column; translocation beneath the surface; and the available forms of residue. The residue level in any organism is a result of a balance of uptake and clearance processes. Factors influencing the residue concentration in aquatic invertebrates include biological uptake of residues, residues acquired directly from the water, residues acquired with the diet, and clearance of residues. A model of residue accumulation is presented and discussed. Hazards of residues affect not only the microsystem of the individual species, but also the macrosystem of communities. The immediate toxic effects of various compounds on particular species can be determined with reasonable assurance, but the general hazards are more difficult to evaluate basically because suitable criteria for observing ecosystem responses to stress are lacking.

74-2297. Johnson, D. W. (Dept. Biol., Idaho State Univ., Pocatello, ID). **Pesticide residues in fish.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 181-212.* (160 references)

The variation in accumulation and elimination of pesticides and the importance of residues to fish population survival may be a function of fish condition based on lipid content. A relation between fat content and residue concentration has been observed. Fish in higher trophic levels have the greatest percentages of metabolites of DDT, heptachlor epoxide, and dieldrin. No correlation between residues in fish and their sex was found; however, a relation with age and fat content was established. Seasonal correlation between fish residues and pesticide usage is common. Differences exist in the metabolism of residues between habitats. Endothall derivative herbicide residues do not accumulate in fish. Sodium arsenite produced residues in fish muscle and in viscera within 11 days of exposure. An inverse correlation was noted between susceptibility of a taxonomic group and pesticide concentrations in their tissues. Residues in fish tissues differ from organ to organ. Sources of residues include the atmosphere, sediment from cropland run-off or irrigation water and effluent from industrial sources. Pesticide solubility interactions, chemical structure, fish conditions, variations in metabolic patterns, and habitat are all implicated in the regulation of pesticide uptake and persistence. The effects of turbidity, degradation, interaction, elimination, trophic level, and solubility on pesticide reduction and elimination are discussed. Hazards due to residues are presented in relation to accumulation in the fish and secondary losses concerning reproductive failures and susceptibility to increased predation. A need for research in the areas of residue effects, fate of residues, enzyme relationships, and endocrine relationships is stressed.

74-2298. Stickel, L. F. (Patuxent Wildlife Res. Cent., Laurel, MD). **Pesticide residues in birds and mammals.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 254-312.* (244 references)

Organochlorine pesticides accumulate in the fat of birds from a relatively small exposure. Instances where pesticides have been employed in the eradication of harmful insects and diseases have resulted in the subsequent deaths of large numbers of wild birds. Environmental contamination by factory wastes is also a problem for bird mortality. Birds which eat other birds usually have higher residues than birds which eat seeds and vegetation. The uptake, loss, and equilibrium of pesticides at sublethal doses differ from the metabolic pattern at lethal doses, and both conditions are discussed. Pesticides have effects on bird physiology, including the thin eggshell problem, enzymes and hormones, and other reproductive effects. The occurrence and persistence of organochlorine pesticides in wild aquatic mammals is discussed. Many studies are being conducted concerning the metabolism, kinetics, and physiological effects of organochlorine pesticides on laboratory and domestic mammals. Not many studies have been undertaken on wild mammals. The concentrations of organochlorine pesticides in fat of big game animals are listed. Residues in the fat of these animals are generally low except in areas treated directly.

74-2299. Davies, J. E. (Pesticides of Dade County, Miami, FL). **Pesticide residues in man.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 313-333.* (78 references)

Human exposure to pesticides is of three types: acute exposure resulting usually from accidental con-

tamination, chronic exposure frequently comprising occupational exposure, and incidental exposure resulting from the ubiquity of pesticides and their presence in trace amounts in air, water, food, and dust. Both the qualitative and quantitative characteristics of human pesticide residues have increased in recent years. The level of human pesticide residues carries with it certain interpretations concerning human disease, drug metabolism, mental retardation, and dietary habits. Principal sources of human pesticide residues include environmental residues in food, air, and water; controlled voluntary human exposure studies; and descriptive epidemiologic studies of human pesticide residues. The last includes considerations of age, race, sex, ethnic differences, occupation, drug usage, social class, and geographical localization. Factors influencing persistence of pesticides are related largely to the lipotrophic characteristics of the pesticide. Efforts have been made to lower tissue residues in animals deliberately by pharmacological methods. Increased metabolism and diminished storage of benzene hexachloride, dieldrin, and DDT have all been demonstrated. The feasibility of this interaction in man was suggested by the reduction of fat storage residues of DDT and its metabolites and dieldrin in 14 volunteers given 100 mg diphenylhydantoin daily for 9 months.

74-2300. Duggan, R. E.; Duggan, M. B. (Dept. Health, Educ., Welfare, FDA, Rockville, MD). **Pesticide residues in food.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 334-364.* (44 references)

Data concerning the amount of pesticide residues in food comes generally from three sources: research data, relating the residue to known amounts of application, timing, and conditions of preparation and storage; surveillance data, from law enforcement of health inspectors looking for violations of the regulations; and survey data, accumulated to determine what is the usual or average situation. There are hazards in comparing and correlating data from different investigations, and care must be exercised in any such undertaking. However, general findings have been documented regarding pesticide residues in human food. Organic residues commonly found in total diet studies in the United States from 1965 to 1970 are listed, as are U. S. food samples containing pesticide residues exceeding 2 ppm. Tables are also included showing the average amounts of pesticide chemicals in dairy products (fat basis) and the DDT residue levels in raw and ready-to-eat foods. The sources of these residues are many with agricultural procedures being the most obvious. Others include pesticide use for disease control, forest protection, disposal of pesticide containers, weed control on highways, home and garden usage of pesticides, and industrial contamination. Pesticides differ in their persistence in the food chain based largely on their chemical characteristics. Hazards to man include carcinogenesis, mutagenesis, and teratogenic effects which are not extensively known. The most effective means of minimizing residues lies in regulating the use of these toxic compounds.

74-2301. Wheatley, G. A. (Nat. Vegetable Res. Sta., Wellesbourne, England). **Pesticides in the atmosphere.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 365-408.* (126 references)

The atmosphere is only a transport medium for pesticides. It is not a medium in which they are biologically active although they can react chemically or photochemically while airborne. Present knowledge indicates that pesticides are confined to the troposphere. Meteorological phenomena and associated air movements are important factors in the redistribution of entrained matter. Pesticide entry into the atmosphere can be intermittent from point sources or continuous. The former case includes particulate drift occurring during outside application, vapor entry during application, or entry by wind erosion. Continuous entry arises from surfaces which have been treated with pesticides and occurs in the form of particulate or vapor transfer. Methods of measuring pesticide concentration in high, intermediate, and background concentrations, in the presence of rain or air, are discussed. Once the vapor or particulate phase enters the atmosphere the molecules will interchange between the two phases to establish appropriate equilibrium as determined by the nature of the particulate matter, the chemical properties of the pesticides, and the basic laws governing solid absorption processes. The principal means of residue removal are probably chemical degradation or change, and fall-out, whether dry or by rain.

74-2302. Edwards, C. A. (Rothamsted Exp. Sta., Harpenden, Herts., England). **Pesticide residues in soil and water.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 409-458.* (229 references)

The amount of pesticide residues found in soil depends to an extent on the type of soil and its usage. Residue concentrations differ in soils from orchards, horticultural soils, and agricultural soils. The sources of residue contamination include soil treatments, spray fall-out, rain and dust carried chemicals, and crop and animal remains. The persistence of the chemicals in the soil is determined by the chemical nature of the insecticides, type of soil, organic matter content, clay content, soil acidity, mineral ion content, temperature, soil moisture, effect of crops, and cultivation. Hazards caused by these residues are evident in soil microorganisms, terrestrial invertebrates, entry into food chains, sublethal effects on soil invertebrates and phytotoxicity. Residues disappear from the soil by volatilization, leaching, runoff, microbial breakdown, and plant uptake. The amount of residue in soil can be minimized by methods of application, legislation, cultivation, flooding or irriga-

tion, addition of materials, stimulating microbial activity, and using alternative chemicals. Residues occur in fresh water, estuaries, and sea water. They arise from run-off of agricultural land, spraying, industrial effluent, sewage, sheep dips, and from dust and rain. The persistence of insecticides in water is influenced by solubility, bottom organic matter, temperature, and pH. The hazards of residues in water include effects on human drinking water and recycling of the residue into the atmosphere. Residues in water can be minimized by using alternative control measures and may be removed by water treatment facilities.

74-2303. Robinson, J. (Shell Res., Woodstock Agr. Res. Cent., Sittingbourne, Kent, England). **Dynamics of pesticide residues in the environment.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 459-493.* (132 references)

Agricultural usage is an important source of pesticide entry into the atmosphere. The rate of entry and the distances over which the residues move are dependent on the vapor pressure of the pesticides and the prevailing meteorological conditions. The majority of pesticides entering the atmosphere in a particular area is deposited locally. Transport over long distances is not customary. The tendency toward local deposition is related to the scavenging of pesticides from the atmosphere, deposition of dust, photochemical decomposition and washout by rain. Entry into the hydrosphere and lithosphere are also discussed. The transport and degradation of residues by organisms is discussed. A compartmental model is presented which makes it possible to simulate the dynamics of pesticides in vertebrates. The major components of the biosphere are not isolated from each other, and various models of use in studying the mechanisms of transport of pesticides in the biosphere are presented.

74-2304. Matsumura, F. (Dept. Entomol., Univ. Wisconsin, Madison, WI). **Degradation of pesticide residues in the environmennt.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 494-513.* (76 references)

The most important factor contributing to the speed of pesticide degradation is the chemical nature of the pesticide itself. Residual characteristics of a pesticide can be influenced by adsorption by soil constituents, leaching by rain water, uptake by plants and animals, evaporation directly or with water vapor, or wind erosion. The degradation of DDT and analogs, BHC, cyclodienes, halogenated aliphatic acids, phenylureas, phenylcarbamates, triazine herbicides, phenoxyalkanoate herbicides, and organophosphate and carbamate insecticides by microorganisms and soils is discussed. Degradation of organochlorine insecticides and aromatic pesticides by sunlight is also discussed. Even though the degradation patterns of pesticides by environmental factors is complex, it is important to consider whether such degradation products which result are stable enough to become terminal residues, whether such terminal residues have such a strong affinity for biological materials as to cause biological magnification phenomena, and whether these products are harmful to any form of biological system. Studies of metabolic and physical degradation activities in the environment should be primarily concerned with the detection of potential terminal residues.

74-2305. Hoerger, F.; Kenaga, E. E. (Agr. Dept., Dow Chem. Corp., Midland, MI 48640). **Pesticide residues on plants: correlation of representative data as a basis for estimation of their magnitude in the environment.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 9-28.* (37 references)

Data on the residues of more than 20 pesticides on more than 60 crops were taken from literature and from United States crop tolerances. Crops were classified into seven different categories based on difference in vegetative yield, surface to mass ratio, and plant interception factors. Upper Limit and Typical Limit residue values have been assigned for each category, both immediately after application and for six weeks thereafter. For a pesticide dosage of 1 lb/acre, upper limit values ranged from 240 ppm on range grass to 7 ppm on fruit immediately after application. The typical limits corresponding to these values were 125 ppm and 1.5 ppm. In between these extremes, in descending order of tolerance, were grass, leaves and leafy crops, forage crops, pods containing seeds, and grain. Estimates based on these findings provide increased reliability in defining the toxicological significance of pesticides as related to the food supply of man, domestic animals, birds, and other wildlife. The impact of a proposed pesticidal-cultural practice may be evaluated more completely prior to commercialization using this data.

74-2306. Rosen, J. D. (Dept. Food Sci., Rutgers Univ., New Brunswick, N.J. 08903). **Conversion of pesticides under environmental conditions.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 85-96.* (57 references)

Many of the pesticides in use today undergo some sort of transformation when subjected to environmental conditions. The persistence, toxicology, and ecological implications of the environmental metabolites are, however, largely unknown. Most of the reactions are photochemical in nature, since very few pesticides, by virtue of their chemical structure, are able to react with essentially neutral water at environmental temperatures or undergo thermal degradation at these temperatures. UV irradiation in sunlight under field conditions involves reactions of such pesticides as chlorinated cyclodienes,

carbamates, diphenylethanes, thiophosphates, and herbicides (with aromatic halogen, phenoxy acids, chlorinated phenols, phenylureas, anilides, and bipyridylium salts). The rates at which these reactions occur are not clear. Those reactions which are not photochemical in nature but which do occur in the inanimate environment are mainly hydrolysis. These involve heptachlor, 1,3-dichloropropene, chlorophenamidine (chlordimeform), diazinon, diazoxon, ronnel, chlorpyrifos, simazine, atrazine, propazine, and propanil.

74-2307. Elgar, K. E.; Mathews, B. L.; Bosio, P. (Shell Res. Ltd., Kent, England). **Vapona strips in shops—residues in foodstuffs.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 217-221.* (9 references)

In trials in the United Kingdom and France samples of selected foodstuffs were purchased from shops in which Vapona strips (Vapona Pest Strip, dichlorvos a.i.) had been placed. Residues of dichlorvos were determined by cholinesterase inhibition. In one trial, residues of the hydrolysis product, dichloroacetaldehyde, were determined by gas liquid chromatographic methods. The results showed that the majority of all dichlorvos residues was less than 0.05 ppm (the limit of determination) (78% in the United Kingdom trial, 66% in the French trial). The concentration of dichloroacetaldehyde in all samples from the United Kingdom was less than 0.03 ppm. Mean concentrations of dichlorvos in air ranged from 0.03 to less than 0.01 μg/liter.

74-2308. Cruz, M.; White, J. L. (Dept. Agronomy, Purdue Univ., Lafayette, IN). **Surface chemistry of pesticide-soil interactions.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 221-223.* (20 references)

Infrared techniques disclosed protonation and subsequent hydrolysis of propazine to the protonated hydroxytriazine form. The surface acidity of NH_4-montmorillonite was equivalent to a pH of 3.25 or lower in an aqueous system, resulting from protonation and hydrolysis of adsorbed propazine. This ability of the clay or colloid surface to transform the uncharged propazine molecule to a protonated molecule has a significant effect on the adsorption and movement of the compound in soils. The *s*-triazines may be moved only with extreme difficulty in certain soils. The geometric restriction of the interlayer space may protect the adsorbed *s*-triazine or its degradation product from microbial attack. The surface acidity of the clay may also induce hydrolysis, thus degrading and detoxifying the *s*-triazine. Infrared spectroscopy is extremely useful in elucidating the interactions of pesticides with soil surfaces. Studies of pleochroism in one- and two-layer propazine-montmorillonite complexes have given information on the geometrical orientation of the adsorbate molecule with respect to the mineral surface.

74-2309. Heeschen, W. (Inst. fuer Milchhygiene, Bundesanstalt fuer Milchforschung, Kiel, Germany). **Analyses for residues in milk and milk products.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 229-234.*

Pesticides of particular importance for milk hygiene are used on a broad basis in the animal or the animal environment and can be secreted with the milk. Extensive examinations for residues of menichlopholane, oxychlozonide, and chlorinated insecticides have not been made in the areas of milk and milk products until recently. Research is still needed regarding toxicology and residue problems of parasiticides used regionally, also on lactating animals. Milk and milk products alone are not dangerously contaminated at present, since the residues contained therein are far from reaching the acceptable daily intake levels. Within the compass of total food intake, milk fat supplies a considerable portion of residues of chlorinated hydrocarbons.

74-2310. Sievers, J. F.; Aurand, K.; Herzel, F.; Hoeffken, F.; Koppe, P.; Niemitz, W. (Inst. fuer Wasser-, Boden- und Lufthyg., 1 Berlin 33, Germany). **Untersuchungen ueber den Endosulfan-Gehalt im Rehin, Main und in Uferfiltraten (Juni 1969-Februar 1970). [Studies on the endosulfan content of the Rhine and Main rivers and of siverbank filtratess.]** *IN: Environmental Quality and Safety, Volume 1, Georg Thieme Verlag/Shuttgart New York, 1972, pp. 239-243.* (8 references) (German)

Massive fish deaths in the Rhine below Bingen in 1969 prompted a search for the sources of contamination and a study of the possible consequences for consumers of treated river water. Water collected from various points on the Rhine between June and December 1969 contained from less than 10 to 3400 ng/l of endosulfan. Water from the Main contained considerably larger quantities; samples collected at Kelsterbach on Dec. 9, 1969, contained 14 μg/l. Endosulfan residues in the riverbank filtrates (used for drinking) from Dusseldorf to Wuppertal did not exceed 35 ppm during the time period mentioned. Evaluation of results is difficult due to the lack of homogeneity in the rivers at many points; however, a daily endosulfan load of 30 kg was calculated based on analyses at a point where thorough mixing of streams was assured.

74-2311. Matsumura, F. (Dept. Entomol., Univ. Wisconsin, Madison, WI). **Current pesticide situation in the USA.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 33-60.* (44 references)

About 75% of the pesticides used in the U.S. are

applied to less than 2% of the land area. It is estimated that about 10 billion pounds of pesticides have been used in the U.S. since 1945. Obviously, some areas are intensely treated, e.g., areas used in cotton production. The majority of pesticides applied by any method eventually reaches the surface of the earth where two major decay reactions occur: first, a fast decay called dissipation, and second, a slow decay reaction called persistence. Water and air are two major physical factors which facilitate the movement of non-degraded pesticides. The bulk of the land in the U.S. which is treated with insecticides is in the plains and coastal areas which are served by slow moving river systems with an abundance of adjacent lakes. Levels of pesticides in the river deltas are high and, due to usually slow exchange rates in lakes, pesticide pollution can be a problem there as well. Studies indicate that the amount of pesticides carried by air-borne dust in the continental U.S. is in excess of that found elsewhere. Industrial sources of pesticide pollution, including pesticide manufacturing and formulating plants as well as plants which utilize pesticides in their manufacturing processes, must also be considered. Aerial spraying is still the most important source of pesticide environmental contamination. General levels of pesticide residues in soils, in human fatty tissues and in human diets are also presented.

74-2312. Brooks, G. T. (Agr. Res. Council, Univ. Sussex, Brighton, England). **Pesticides in Britain.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 61-114.* (49 references)

Public concern over ill effects of pesticides in non-target organisms began in Britain in the early 1960s. However, slightly prior to that time, voluntary limitations on uses of pesticides had begun. Use of organochlorines on crops has been decreasing; however, a progressive increase in the use of organophosphorus insecticides has been noted. Use of organochlorines in food storage and for veterinary, home, and other purposes has been studied. Herbicide usage has increased greatly since 1964, including use on cereal crops, sugar beets, potatoes, fruits, vegetables, and in forestry. The major source of environmental contamination due to pesticides clearly arises from their application to plants on soils. The use of certain pesticides is declining, both by design and by development of resistant strains. Pesticide contamination in air results mainly from evaporation from soil and plants. Average values for total organochlorine insecticide content in rain water samples are considered. Drainage water is not a serious source of contamination in Britain due to the strong adsorption of organochlorines on soil particles. The presence of organochlorine pesticides has been indicated in the open sea by their occurrence in marine organisms living and feeding far from land. Effects on soil organisms, plants, aquatic organisms, terrestial vertebrates, and insects are considered.

74-2313. Tonomura, K.; Furukawa, K.; Yamada, M. (Fermentation Res. Inst., Chiba-shi, Japan). **Microbial conversion of mercury compounds.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 115-133.* (15 references)

Environmental pollution by mercury is a problem, particularly in Japan. Changes occurring to mercury compounds in nature have been studied. Methylmercuric chloride, ethylmercuric phosphate, phenylmercuric acetate, and mercuric chloride were decomposed to metallic mercury by *Pseudomonas* strain K 62. Methyl mercury was formed by *Clostridium cochlearium*. At lower than -200 mv of a redox-potential, sulfate-reducing bacteria produce great amounts of hydrogen sulfate from sulfate which chemically converts mercuric ions to HgS. A methanogenic bacterium produces methylmercury. The formation of methylmercury was not observed during methane fermentation. The formation of methylmercury was not observed in the process of activated sludge. The reductive decomposition of phenylmercuric acetate and mercuric chloride by activated sludge was observed. Thus it is suggested that mercury undergoes repeated changes in the process of natural circulation.

74-2314. Tatsukawa, R.; Wakimoto, T.; Ogawa, T. (Coll. Agr., Ehime Univ., Japan). **BHC residues in the environment.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 229-238.* (3 references)

The environmental fate and distribution of BHC as used in paddy fields was examined. In the peak year of BHC use, 1968, an estimated 890 grams of gamma-BHC (lindane) was used per hectare on arable land in western Japan. In Fukuoka and Saga Prefectures of North Kyushu more than 4 kg of gamma-BHC per hectare was used. Residue levels of BHC in soil, water, air, and various biota are roughly proportional to the amounts used. BHC residues in paddy field soils are not as high as expected in areas of intensive spraying because BHC is degraded faster under water logged conditions than under upland conditions. Also, the higher the soil temperature, the more rapid is BHC degradation. The most rapidly degrading BHC isomer is the gamma isomer, followed by the alpha, beta, and delta forms. Although accumulation of BHC is higher in western Japan, residue rates are higher in eastern regions due to colder climate. BHC levels in fresh surface waters fluctuate widely depending on the growing season. BHC sprayed on paddy fields vaporizes rapidly, causing atmospheric and rain pollution in wide areas. Biota in the environment also accumulate BHC, beta-BHC being the most persistent and most concentrated isomer in animal tissue. Almost all of the BHC reaching man comes from food, particularly beef, milk, butter, and cheese. Air and fresh surface water serve as transport mechanisms for BHC. The atmosphere plays a role in the fate of BHC, aiding in its rapid degradation by sunlight.

74-2315. Tanabe, H. (Nat. Inst. Hyg. Sci., Tokyo, Japan). **Contamination of milk with chlorinated hydrocarbon pesticides.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 239-256.*

A national survey was conducted in Japan concerning the levels of chlorinated hydrocarbon pesticide residues in milk and dairy products. Attempts were made to trace the sources of contamination. The origin of beta-BHC contamination of cow's milk was rice straw, the main feed for cows in Japan. In attempting to suppress damage due to *Chilo suppressalis*, the technical grade of BHC had been used instead of the purified gamma-BHC, the latter being more than twice as expensive. Contamination with BHC in different areas almost paralleled pesticide use. Efforts to lower the beta-BHC level in milk were undertaken, and a tentative ADI for beta-BHC was set at 0.05 mg/kg/day. The guideline for the beta-BHC level in cows milk was set at 0.2 ppm. Other data collected on BHC contamination indicated that beef was much more contaminated with beta-BHC than any other animal food. Data on human milk contamination was also collected and indicated that oral daily intake of cow's milk and beef were the main contamination routes for human milk and the human body.

74-2316. Hurtig, H. (Environ. Qual. Res. Br., Canada Dept. Agr., Ottawa, Canada). **Long-distance transport of pesticides.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 257-280.* (21 references)

The routes by which pesticides reach water include direct injection into the atmosphere during application and the recycling of pesticides in soil to other sectors of the environment. Mechanisms of pesticide loss from soil include volatilization, photodecomposition, chemical decomposition, adsorption, leaching, dilution, mechanical removal (erosion), plant uptake, microbial decomposition, and codistillation. In the soil-water and atmosphere-water sequence of transfer of pesticide residues the magnification phenomenon in aquatic food chains has been well noted. The use of shellfish, bivalves, and predatory fish in monitoring operations for detecting overt contamination of water from pesticide atmospheric drift and for the slower transport of pesticides with erosion and drainage from treated lands and forests is of great value. In order to limit water contamination the use of the specific pesticide must be examined along with its method of application in relation to the agronomic practices, soil type, and geology of the particular region in question. Work is underway for designing mathematical models which will provide a long look ahead into pesticide contamination of aquatic ecosystems. Work is needed in the area of the atmospheric transport aspects over long distances.

74-2317. Ishida, M. (Sankyo Co., Ltd., Agr. Chem. Res. Labs., Yasucho, Shiga Prefect. Japan). **Fungicides, herbicides, organophosphates and carbamates.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 281-306.* (9 references)

Severe leaf malformation of tomato, melon, and cucumber plants was reported in Japan following use of compost prepared from rice straw on which pentachlorobenzyl alcohol preparations had been applied the previous year. Chlorinated benzoic acids were tested; 2,3,5,6-tetrachlorobenzoic acid and 2,3,6-trichlorobenzoic acid caused the most severe leaf injury. Dechlorination at the para position increased the phytotoxic activity. No reasonable amounts of these phytotoxic acids or their possible precursors were noted in the technical grade pentachlorobenzoic acids and in structurally related herbicides. Biotransformation studies indicate that all three isomers of tetrachlorobenzoic acid are biologically produced from pentachlorobenzyl alcohol. An extensive survey on contamination of rice chaff and straw, rice straw compost, and paddy field soil by polychlorobenzyl alcohols and polychlorobenzoic acids revealed that most contained pentachlorobenzyl alcohol, pentachlorobenzoic acid, and 2,3,4,6- and/or 2,3,5,6-tetrachlorobenzoic acid. No effect of pentachlorobenzyl alcohol on the growth of bacteria and actinomycetes in soil was observed at concentrations of 100 and 1,000 ppm in soil. Pentachlorobenzyl alcohol is substantially non-toxic to mammals and insects. Production and marketing of pentachlorobenzyl alcohol preparations were discontinued in June, 1968, when its biotransformation to persistent phytotoxic acids in soil became clear.

74-2318. Uesugi, Y.; Tomizawa, C.; Murai, T. (Nat. Inst. Agr. Sci., Tokyo, Japan). **Degradation of organophosphorus fungicides.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 327-339.* (18 references)

Degradation studies indicated that Kitazin P, *S*-benzyl diisopropyl phosphorothiolate, has a half-life of 80 days and Hinosan, ethyl *S,S*-diphenyl phosphorodithiolate, has a half-life of 60 hr. Inezin, *S*-benzyl ethyl phenylphosphonothiolate, has a rate constant on the same order as Kitazin P. Degradation of these organophosphorus fungicides was accelerated by addition of organisms or irradiation with UV light. In most cases the degradation products were mainly hydrolysates of the parent fungicides. The phosphorus partial esters which were found as degradation products were almost nontoxic to rice blast fungus, thus cleavage of the ester linkage means detoxication to the fungus. Hydroxy derivatives have been found as fat-soluble metabolites or organophosphorus fungicides, however, the pathway leading to these metabolites is minor. Hydroxylation of Kitazin P resulted in the detoxication of this compound to the fungus. Isomerization of the fungicides seems strictly related to the wavelength of UV light. Transesterification also occurs in some cases.

74-2319. Kuwatsuka, S. (Dept. Agr. Chem., Nagoya Univ., Nagoya, Japan). **Degradation of several herbicides in soils under different conditions.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 385-400.* (26 references)

The degradation of herbicides differs on uplands versus paddy fields. Photodecomposition is perhaps the major degradation process in paddy fields. Pentachlorophenol disappears more rapidly from soils at higher temperatures and under flooded conditions than under nonflooded upland conditions. Degradation was assumed to proceed by both chemical and microbial means. Swep (methyl *N*-3,4-dichlorophenylcarbamate), used mainly for soil surface treatments, was degraded more slowly than propanil in both flooded and nonflooded soils. Degradation of both chemicals was affected by flooding and temperature but not by the pH of the soils. Benthiocarb degradation products are readily degraded to smaller or very polar materials, which are unextractable with organic solvents, although benthiocarb itself is stable in the soil. In spite of its comparatively long persistence in soils, the possibility of translocation and residual pollution of benthiocarb in rice grains is probably low. Degradation of diphenylethers was slower under upland conditions than under flooded ones, and no amino derivatives were detected in soils under upland conditions. Under flooded conditions amino derivatives were the major metabolites in earlier stages of incubation.

74-2320. Crosby, D. G.; Moilanen, K. W.; Nakagawa, M.; Wong, A. S. (Dept. Environ. Toxicol., Univ. California, Davis, CA). **Photodecomposition of pesticides.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 423-433.* (28 references)

Photonucleophilic reactions of pesticides are commonplace and extensive. They occur wherever water and light occur together, and sunlight undoubtedly supplies sufficient illumination. In addition to the hydroxide and hydronium ions which are present, natural waters often contain or adjoin many nucleophiles including chloride and bromide ions, sulfides, ammonia, and the amine or thiol end groups which occur throughout biological matter. The contact and reaction of such reagents with light-activated pesticides is significant. The toxicological significance of the reaction products thus obtained remains largely unknown. The ease with which these reactions occur at ambient temperature in highly dilute aqueous media suggests that photonucleophilic displacements may be pertinent to the mechanisms of herbicidal action of the diphenylethers, triazines, and other substances affecting light-energized processes in green plants.

74-2321. Rosen, J. D. (Dept. Food Sci., Rutgers, The State Univ., New Brunswick, NJ 08903). **The photochemistry of several pesticides.** *IN: Environmental Toxicolgty of Pesticides. Academic Press, New York, 1972, p. 435-447.* (15 references)

Irradiation with sunlight of the synthetic pyrethroid, SBP-1382, absorbed on silica gel, caused rapid photodecomposition with no detectable starting material remaining after 5 hr. Repeating the experiment using glass plates again showed rapid decomposition of the solar-irradiated material, but the thin-layer chromatogram of the irradiated mixture of the glass plates was completely different from that of the silica gel irradiation. Thus, in some cases, it may not even be possible to extend results from silica gel to glass, much less to soil and leaf surfaces. Solar irradiation of nitralin proceeded rapidly on glass, silica gel, and in acetone or methanol solution. A substance was formed in each instance which suggested dimerization at the methylsulfonyl group. In solar irradiation of pyrazon, two dimers were rapidly formed. The larvicide, Abate, experienced rapid decomposition on exposure to sunlight in methanol solution. The major initial product was the abate-sulfoxide which further photolyzed rapidly to at least six other products. The herbicide, aglypt, was rapidly converted to 3-methylthio-6-phenyl-1,2,4-triazin-5-one.

74-2322. Lykken, L. (Div. Entomology, Univ. California, Berkeley, CA 94720). **Role of photosensitizers in alteration of pesticide residues in sunlight.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 449-469.* (21 references)

The chemical transformation of pesticide surface residues is promoted by ultraviolet light. The degree of persistence of pesticides may be regulated by the application of photosensitizers which enhance or stabilize the alteration of the pesticide by sunlight. Benzophenone accelerates the production of photoproducts in solutions containing aldrin, dieldrin, heptachlor, and isodrin. It is also effective in the photolysis of chloroanilines, as is flavin mononucleotide. Certain aromatic amines induce the photolysis of DDT, and chlorophyll catalyzes the photodegradation of pyrethroids. Rotenone is most effective for conversion of dieldrin to photodieldrin on plant foliage exposed to sunlight and for the photoalteration of various other pesticide chemicals. Some aromatic amines sensitize the photodecomposition of DDT as well as several chlorinated cyclodienes, possibly by formation of charge-transfer complexes. Anthraquinone shows the highest activity of the photosensitizers tested in combination with organophosphorus compounds, methylcarbamates, pyrethroids, dinitrophenol derivatives, piperonyl butoxide, and 2,4-D. There is evidence that the use of photosensitizers uncovers photoproducts which might have been overlooked without them.

74-2323. Rudd, R. L.; Herman, S. G. (Dept. Zool., Univ. California, Davis, CA). **Ecosystemic transferal of pesticides residues in an aquatic environment.** *IN: Envi-*

ronmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 471-485. (40 references)

The entire ecosystem in Clear Lake, California, contains chlorinated hydrocarbon residues, chiefly of the DDT series, originating from several sources, including direct application of DDT derivatives to the lake to control gnat, inflow waters from surrounding agricultural lands, migratory birds, and probably also from household and atmospheric origins. This contamination caused total cessation of breeding in a colony of a fish-eating bird, the Western grebe (*Aechmophorus occidentalis*). The survivability of residues, their distribution in the food-web, their effect on populations, their concentrations following biological magnification in food-chains, and the physiological mechanisms causing the observed reproductive effects in birds have been studied. Residue levels of DDT derivatives from bottom muds average 0.8 ppm. Core sediment samples indicate a vertical residue gradient to a level of 18 inches below the top of substratum. Oligochaete worms of these sediments averaged 3.41 ppm DDT derivatives whole body, net weight. An increasing stored residue concentration follows in fishes and birds, sometimes totaling 700 ppm in lipid tissues. Introduction of a small Atherinid fish in 1967 had caused a sudden decline in residue levels in the tissues of fish-eating birds. Near normal reproductive success has returned to the Western grebe colony, but both eggshell thickness and egg weights remain significantly reduced.

74-2324. Matsumura, F. (Dept. Entomol., Univ. Wisconsin, Madison, WI). **Biological effects of toxic pesticidal contaminants and terminal residues.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 525-548.* (58 references)

Terminal residues are those chemicals which remain in the environment longer than the pesticide principles. These terminal residues may be the original stable pesticide, conversion products, and the chemical impurities in the crude pesticidal preparation. Commonly occurring terminal residues in the environment include DDT analogs, lindane, dieldrin, heptachlor epoxide, and endrin. The aromatic herbicides, phenylureas and phenylcarbamates do not persist long in the soil. Ring-substituted anilines are the resulting end products of microbial attacks on these chemicals. Phenoxyalkanoate herbicides also undergo ready degradation with substituted phenols subject to further ring hydroxylation as the end products. A recently discovered carcinogenic terminal residue, ethylene thiourea, stems from ethylene bis(dithiocarbamate) fungicides. Biological effects of terminal residues include acute toxicities, as well as chronic and subacute effects.

74-2325. Ismail, M. A.; Wardowski, W. F. (AREC, Lake Alfred, FL). **Sources of phenolic contamination and its removal from citrus packinghouse effluent.** *Hortscience 8(3): 273; 1973.*

According to the Florida Air and Water Pollution Control Commission, the level of phenolic type compounds may not exceed 0.001 mg/liter (1 ppb) after reasonable opportunity for mixture of wastes with receiving waters. Water effluents from several packinghouses and some municipal and well water supplies exceeded the 1 ppb limit. Most of the phenolic contamination in citrus packinghouse effluents is derived from the fungicide *o*-phenylphenol and its sodium salt, some detergents, and Citrus Red No. 2. Some phenolic contamination is also caused by leaves, twigs, fruits, and insect debris. A method has been devised for the rapid removal of 92-95% of phenolic type compounds from packinghouse effluent; the method makes use of an insoluble form of polyvinylpyrrolidone.

74-2326. Richou-Bac, L. (Lab. Central d'Hygiene Alimentaire, Services Veterinaires, Paris, France). **Les residus de pesticides et de polluants organo-chlores dans les denrees d'origine animale. [Organochlorine pesticide and pollutant residues in foods of animal origin.]** *Ind. Aliment. Agr. 91(3): 193-202; 1974.* (French)

Results of organochlorine pesticide and PCB residue analyses in food products of animal origin were carried out in France. The studies on the effects of trace quantities of residues on the animals are reviewed. Residues of organochlorine pesticides, such as hexachlorobenzene, lindane, heptachlor epoxide, and dieldrin, are among the main contaminants in food products of animal origin, particularly milk and dairy products. In France, the degree of contamination has considerably diminished since the first restrictive administrative measures were taken in 1969. While DDT is found only rarely in food products, BHC is present frequently in fairly low concentrations. PCBs and veterinary preparations are not worrisome in France. Once in the body, organochlorine pesticide residues cause hepatomegaly enzyme induction, and increased microsomal protein synthesis. Estrogenic effects of *o,p'*-DDT, methoxychlor, and *p,p'*-DDT were determined in rats. Small doses of DDT and dieldrin interfered with the testosterone and progesterone metabolism by stimulating the hepatic enzyme activity.

74-2327. Morley, H. V. (Chem. Biol. Res. Inst., Canada Dept. Agr., Ottawa, Canada). **Soil-pesticide interactions.** *IN: International Symposium on Identification and Measurement of Environmental Pollutants. Campbell Printing, Ottawa, 1971, pp. 69-71.* (18 references)

Soil is a highly reactive medium capable of binding by adsorption, partition, ion-exchange, or exclusion type chromatography; it may be expected then that a pesticide will be more or less tightly bound, depending on its chemical properties and spatial configuration. Pesticides or their transformation products may interact with soil so that they are chemically or biologically non-available. In spite of these factors, pesticides move through the soil

and at some point solubilization apparently takes place so that root hair uptake occurs. Pesticide transformation occurs in the soil, and a knowledge of optimal conditions for degradation may enable measures to be taken to accelerate the rate of degradation. The availability of the pesticide itself for degradation may be the rate determining step. Transformation may be metabolically effected by soil microorganisms, higher plants and animals, or by enzymes present in the soil. Nonmetabolic transformation may be accomplished by photodecomposition, hydrolysis, or dealkylation.

74-2328. Caro, J. H.; Taylor, A. W.; Lemon, E. R. (U.S. Soils Lab., Soil and Water Conserv. Res. Div., ARS, USDA, Plant Ind. Sta., Beltsville, MD 20705). **Measurement of pesticide concentrations in the air overlying a treated field.** *IN: International Symposium on Identification and Measurement of Environmental Pollutants. Campbell Printing, Ottawa, 1971, pp. 72-77.* (10 references)

In 1968, dieldrin was continuously trapped on fiberglass filters suspended above a treated field and measured at 2-week intervals. In 1969, dieldrin and heptachlor concentrations above a second field were measured on seven days throughout the crop season. The pesticides were collected at several heights by extraction of the air in hexylene glycol and were determined by gas chromatography of the extracts. Parallel measurements of moisture gradients permitted calculation of pesticide flux rates out of the soil or the crop canopy. The collection apparatus, analytical methodology, and mathematical derivations used in the 2-year program are described. Results in 1968 showed significant condensation of airborne pesticides on exposed surfaces. In 1969, 2.8% of the dieldrin and 3.9% of the heptachlor applied to the field were evolved to the air, indicating that vaporization is a major pathway of loss of insecticides from field soils.

74-2329. Duggan, R. E. (USFDA, Public Health Serv., Rockville, MD 20852). **Residues of pesticides in milk, meat and foodstuffs.** *IN: International Symposium on Identification and Measurement of Environmental Pollutants. Campbell Printing, Ottawa, 1971, pp. 239-243.* (14 references)

During the past six years monitoring of food other than meat or poultry revealed pesticide residues in slightly more than half of the 95,736 samples; about one third contained residues of more than one chemical. Of the individual residues, 75-80% were below 0.11 ppm, and 95% were below the 0.51 ppm level. There has been no significant change in the incidence of residues in the general food supply. In regard to meat, the incidence and level of residues in imported meats are not significantly different from domestic meats. The residue level for most pesticide chemicals in red meat does not exceed 0.1 ppm (fat basis) in 97% of the samples. Pesticide residues should also be measured in food as it is actually consumed: reductions obviously occur during the preparation of the food. During the six year history of the total diet study, none of the acceptable daily intake values for pesticide chemicals proposed by the WHO Expert Committee on Pesticide Residues has been surpassed. At least 22 pesticide chemicals are often found in measureable amounts in food ready to consume. Others may be present but may not be measured due to the current lack of suitable analytical methods. Overall, the changes in pesticide residue levels in foods during the past several years have been relatively minor.

74-2330. Fleeker, J. R.; Lacy, H. M.; Schultz, I. R.; Houkom, E. C. (Dept. Biochem., North Dakota State Univ., Fargo, ND 58102). **Persistence and metabolism of thiophanate-methyl in soil.** *J. Agr. Food Chem. 22(4): 592-595; 1974.* (20 references)

The fungicide thiophanate-methyl, 1,2-bis(3-methoxycarbonyl-2-thioureido)benzene, underwent rapid conversion in soil to methyl 2-benzimidazolecarbamate (MBC, BCM). The rate of conversion was more than four times faster in soil at pH 7.4 than in soil at pH 5.6. The rate of thiophanate-methyl conversion to MCB was also reduced by steam treatment of the soil. Soil incubated 51 days with MBC-2-^{14}C (ring) and MBC-*methyl*-^{14}C released less than 1 and 16%, respectively, of the applied radioactivity as $^{14}CO_2$. The recovery of ^{14}C in acetone extracts of MBC-2-^{14}C treated soils was 79-91% in samples extracted immediately after treatment, and 53-78% 43 days after treatment, depending on soil and a rate of application of 10 or 100 ppm. Nearly all of the extractable ^{14}C chromatographed as MBC. (Author abstract reprinted by permission of the American Chemical Society)

74-2331. Smith, A. E. (Agr. Can., Regina Res. Sta., Regina, Saskatchewan, S4P 3A2, Canada). **Breakdown of the herbicide dicamba and its degradation product 3,6-dichlorosalicylic acid in prairie soils.** *J. Agr. Food Chem. 22(4): 601-605; 1974.* (8 references)

The degradation of ^{14}C-ring- and ^{14}C-carboxyl-labeled dicamba was studied in moist nonsterile heavy clay at 25 ± 1° in Pramer and Bartha (1965) flasks. Gas chromatographic and radiochemical analytical techniques were used to monitor the breakdown. Over 50% of the dicamba was lost within 4 weeks, radioactive carbon dioxide and 3,6-dichlorosalicylic acid being the sole degradation products detected. Decomposition of ^{14}C-ring-labeled dicamba was compared in moist nonsterile silty clay, heavy clay, and sandy loam soils at 25 ± 1°. In all soils loss was rapid and complete in 3 weeks. A build-up of 3,6-dichlorosalicylic acid was followed by a slow loss which was complete within 9 weeks. Negligible breakdown of dicamba occurred in steam sterilized soils. Soil slurry adsorptive studies with 3,6-dichlorosalicylic acid indicated at least 30% adsorption to all soil types.

(Author abstract reprinted by permission of the American Chemical Society)

74-2332. Fisher, J. D. (Rohm and Haas Co., Res. Lab., Spring House, PA 19477). **Metabolism of the herbicide pronamide in soil.** *J. Agr. Food Chem. 22(4): 606-608; 1974.* (11 references)

The metabolism of pronamide (3,5-dichloro-*N*-(1,1-dimethyl-2-propynyl)benzamide) in soil was studied under laboratory conditions. [*carbonyl*-^{14}C]Pronamide was applied to sterilized and nonsterilized soils and held at 25° for 33 days. Each soil was monitored for evolved $^{14}CO_2$ as well as total CO_2. Similar comparisons were also made in soil with [*carbonyl*-^{14}C]- and 3,5-[*ring*-^{14}C]dichlorobenzoic acid which is a potential metabolite of pronamide. In nonsterilized soil, approximately 13% of the [^{14}C]pronamide was mineralized to $^{14}CO_2$ after 33 days whereas ca. 81 and 51% of the carbonyl ^{14}C and ring ^{14}C, respectively, of 3,5-dichlorobenzoic acid were mineralized to $^{14}CO_2$ after 28 days. In sterilized soil, essentially no $^{14}CO_2$ was evolved indicating that the observed mineralization of $^{14}CO_2$ in nonsterilized soil was biologically mediated. No effects upon total CO_2 evolution were noted in any of the soil treatments. The level of pronamide plus transformation products was also determined. After 33 days, pronamide made up ca. 45 and 82% of the extractable ^{14}C residues in the nonsterilized and sterilized soils, respectively. (Author abstract reprinted by permission of the American Chemical Society)

74-2333. Weisgerber, I.; Kohli, J.; Kaul, R.; Klein, W.*; Korte, F. (Inst. Oekol. Chem., Schloss Birlinghoven, Gesellschaft fuer Strahlen- und Umweltforschung mbH, Munich, Germany). **Fate of aldrin-^{14}C in maize, wheat, and soils under outdoor conditions.** *J. Agr. Food Chem. 22(4): 609-612; 1974.* (2 references)

Maize has been grown in soils treated with aldrin-^{14}C at locations in Germany (2.9 kg/ha), England (3.0 kg/ha), Spain (3.0 kg/kg), and the United States (3.0 kg/ha), and wheat has been grown in Germany (2.9 kg/ha) and England (3.2 kg/ha). Additionally, aldrin-^{14}C has been applied to wheat seeds at locations in Germany and England (0.1% of the weight of grain). At harvest, residues did not exceed 0.01 ppm in the grain. The main radioactive products identified by glc-mass spectra in soils and in the plants of all locations were dieldrin and dihydrochlordene dicarboxylic acid (1,2,3,4,8,8-hexachloro-1,4,4a,6,7,7a-hexahydro-1,4-endomethyleneindene-5,7-dicarboxylic acid). Unchanged aldrin, photodieldrin, unknown acidic compounds, and an unknown nonpolar metabolite were detected in trace amounts. In wheat soil, up to 5% of the recovered radioactivity was due to photoaldrin. The quantitative data for aldrin and metabolites were different for the four locations. (Author abstract reprinted by permission of the American Chemical Society)

74-2334. Nilles, G. P.; Zabik, M. J.* (Pestic. Res. Cent., Dept. Chem., Michigan State Univ., East Lansing, MI 48824). **Photochemistry of bioactive compounds. Multiphase photodegradation of basalin.** *J. Agr. Food Chem. 22(4): 684-688; 1974.* (13 references)

The photolysis of basalin (fluchloralin, *N*-(2-chloroethyl)-2,6-dinitro-*N*-propyl-4-trifluoromethylbenzeneamine) has been studied in solution, as a thin film, and on soil. The structures of the major photoproducts have been determined and a comparison has been made between laboratory photolysis and natural sunlight photolysis for this compound. The major routes of degradation include photodealkylation, benzimidazole formation, and quinoxaline formation. At 5 ppm in solution, the rate of disappearance of basalin shows zero-order kinetics with a rate constant of 2.6×10^{-7} mol/(l. min). (Author abstract reprinted by permission of the American Chemical Society)

74-2335. Aharonson, N.; Ben-Aziz, A. (Pestic. Chem. Residue Res. Lab., Agr. Res. Org., The Volcani Cent., Bet Dagan, Israel). **Persistence of residues of Velsicol VCS-506 and two of its metabolites in tomatoes and grapes.** *J. Agr. Food Chem. 22(4): 704-706; 1974.* (5 references)

The persistence of Velsicol VCS-506 [*O*-(4-bromo-2,5-dichlorophenyl)-*O*-methyl phenylphosphonothioate] insecticide, its O-analog, and phenol derivative (2,5-dichloro-4-bromophenol) was studied on tomatoes and grapes grown in the coastal plain of Israel during the summer and fall. Chemical analysis of tomato plants sprayed with VCS-506, 3500 g of emulsifiable concentrate/ha, showed that the residue level in the fruit was the same 1 and 21 days posttreatment. During the same time interval, there was only a 20% reduction in the residue level of Velsicol VCS-506 in the leaves, whereas between the third and fifth weeks after treatment, the rate of degradation increased. In grapes that were dipped in a 2.5% VCS-506 emulsifiable concentrate emulsion the residue level was 12 ppm 1 day after treatment and 7.5 ppm 44 days later. The concentration of the phenol derivative in all the samples was 1–10% of that of the parent compound. In both tomatoes and grapes, the highest concentration of this derivative was found 3 weeks after treatment. Accumulation of the O-analog was not found. Translocation of the parent compound from leaves to fruit was not observed, but some translocation of the phenol derivative was detected. Results from the chemical analysis were confirmed by the TLC enzymic inhibition technique. Additional cholinesterase-inhibiting metabolites were not detected. Field application was according to the recommended amounts and procedures. (Author abstract reprinted by permission of the American Chemical Society)

74-2336. Alley, E. G.; Layton, B. R.; Minyard, J. P., Jr. (Mississippi State Chem. Lab., Mississippi State, MS

39762). **Photoreduction of mirex in aliphatic amines.** *J. Agr. Food Chem. 22(4): 727-729; 1974.* (14 references)

Solutions of dodecachloropentacyclo-[5.3.0.$0^{2,6}$.$0^{3,9}$.$0^{4,8}$]decane (Mirex) in aliphatic amines were irradiated with sunlight. Mass spectral, infrared, and nmr data were used to establish that the major photoproducts are 1,2,3,4,5,5,6,7,8,9,10-undecachloropentacyclo-[5.3.0.$0^{2,6}$.$0^{3,9}$.$0^{4,8}$]decane and 1,2,3,4,5,6,7,8,9,10-decachloropentacyclo[5.3.0.$0^{2,6}$.$0^{3,9}$.$0^{4,8}$]decane. Spectroscopic evidence is reported which indicates a charge transfer complex is formed between the amine and Mirex. (Author abstract reprinted by permission of the American Chemical Society)

74-2337. Woodham, D. W.; Reeves, R. G.; Williams, C. B.; Richardson, H.; Bond, C. A. (Plant Protect. and Quarantine Programs, Brownsville, TX 78520). **Residues of dimethoate and its oxygen analog on and in citrus leaves following a helicopter treatment of the trees with dimethoate ultra-low volume concentrate and high volume spray.** *J. Agr. Food Chem. 22(4): 731-733; 1974.* (4 references)

Residues of dimethoate and its oxygen analog (a metabolite of dimethoate) on and in citrus leaves were investigated by a gas chromatographic–flame photometric detector (GC–FPD) procedure following treatment of the trees with (1) a dimethoate ultra-low volume (ULV) concentrate and (2) a high volume (HV) spray, both applied by helicopter at a rate of 1.0 lb/acre. Residues detected 1 day following treatment indicated uniform deposition of the insecticide with both types of application. This was true for all segments of the trees, including the bottom and center sections. The ULV treatment produced higher initial residues than the HV spray, probably due to excessive runoff of the aqueous HV spray solution from the waxy leaf surface. After 14 days weathering, residues on and in leaves from the ULV treated trees were slightly higher than those on leaves from HV sprayed trees. (Author abstract reprinted by permission of the American Chemical Society)

74-2338. Harvey, G. R.; Miklas, H. P.; Bowen, V. T.; Steinhauer, W. G. (Woods Hole Oceanographic Institution, Woods Hole, MA 02543). **Observations on the distribution of chlorinated hydrocarbons in Atlantic Ocean organisms.** *J. Mar. Res. 32(2): 103-118; 1974.* (27 references)

Polychlorinated biphenyls (PCBs) and DDT, DDE, and TDE were measured in several species collected from the Atlantic Ocean between 66° N and 35° S latitude. In all organisms, PCB concentration was higher than that of the DDT family. There was no consistent concentration gradient from near shore to open sea. There was no consistent evidence for food chain magnification of chlorinated hydrocarbons on a wet or lipid weight basis. In fact, mixed plankton have a higher PCB concentration (200μg/kg) than any other class of gilled organism in the Atlantic. This is because lipid stores are the major repository for chlorinated hydrocarbons, and lipid composition varies among species, within species at different seasons and ages, and in different parts of the body. PCBs and DDT move through the marine ecosystem differently. In general, PCB/DDT ratio is greater than 30 in the atmosphere, surface seawater, and plankton, decreasing to 10 or less in the high trophic level predators and to 5 or less in the mesopelagic organisms which live at depths below the thermocline.

74-2339. Tolle, A.; Heeschen, W.; Bluethgen, A. (Institut fuer Hygiene, Bundesanstalt fuer Milchforschung, Kiel, Germany). **Fremdstoffe in Milchnahrungen. [Insecticides, antibiotics and other environmental chemicals in infant nutrition.]** *Monatsschr. Kinderheilk. 122(5): 309-318; 1974.* (42 references) (German)

Residues of organochlorine pesticides, antibiotics, and industrial and traffic-generated heavy metals in milk and processed commercial baby foods are surveyed. In West Germany, a person's consumption of one liter milk per day supplies 2%, 4%, 16.6%, and 0.25%, respectively, of the acceptable daily intake of DDT, heptachlor-heptachlor epoxide, aldrin-dieldrin, and lindane. Systematic investigations of milk samples collected in different parts of West Germany showed a consistent decrease in the α-BHC, γ-BHC, heptachlor, aldrin, and DDT levels in cow's milk. Milk from lactating women is an indicator of the exposure of consumers to residues present in the total diet and from other environmental sources. Mother's milk, the first and sometimes the only food for the breast-fed infant, contains up to 10 times more organochlorine pesticide than cow's milk. In processed commercial baby food, these residues are in the 1-10 ppb range. Residues of antibiotics in milk have decreased consistently since the introduction of the Brilliant Blue reduction test. Only 0.5% of raw milk contained traces of antibiotics, and pasteurized drinking milk was free of such residues. With respect to the WHO/FAO limit values the consumption of milk can be concluded as not hazardous to human health.

74-2340. Vaquer, A. (Centre d'Ecologie de Camargue, Centre National de la Recherche Scientifique, Le Sambuc, 13200-Arles, France). **Absorption et accumulation de residus de certains pesticides et de polychlorobiphenyles par la vegetation aquatique naturelle et par le riz en Camargue. [Absorption and accumulation of pesticide residues and chlorinated biphenyls in wild aquatic vegetation and rice in the Camargue.]** *Oecol. Plant. 8(4): 353-365; 1973.* (23 references) (French)

The accumulation and absorption of α-BHC, lindane, DDT, DDE, and PCBs were studied in *Potamogeton pectinatus* L., *Scirpus palustris* L., *Typha angustifolia* L., *Phragmites communis* Trin., *Juncus maritimus* Lamk., *Oryza sativa* L. var. balilla, and *Enteromorpha*

species in various aquatic habitats in the Camargue (Rhone delta). These species absorbed and accumulated the pesticide residues, present in the water in very low concentrations. Accumulation levels compared with water varied between 16 and 20,000 (dry matter) depending on species. The α-BHC levels in *P. pectinatus, Sc. palustris, T. angustifolia, Ph. communis, J. maritimus, Enteromorpha,* and *O. sativa* were 29, 3, 5, 1, 2, 15, and 10 mg/ton. The corresponding values determined for lindane were 41, 28, 13, 5, 1, 200, and 16 mg/ton, and those determined for PCB were 250, 345, 83, 34, 110, 990, and 220 mg/ton. While DDT was present in the water in concentrations below the detection limit, *P. pectinatus, Sc. palustris, T. angustifolia* and *O. sativum* contained 43, 62, 55, and 61 mg DDT per ton. *P. pectinatus* and *O. sativum* also contained 21 and 27 mg DDE per ton, respectively. The residue levels in plants were usually higher in the leaves than in the roots and at the base of the stem. Also, the concentrations were higher in the fruits than in the plant itself.

74-2341. Ortwein, L. (Nauk. Inst. Ochr. Roslin, Poznan, Poland). **Badania nad skazeniami zajaca szaraka (*Lepus europeaus* Pallas) insektycydami z grupy chlorowanych weglowodorow. [Contamination of hares (*Lepus eutropaeus*) with organochlorine insecticides.]** *Pr. Nauk. Inst. Ochr. Rosl. 14(1): 83-144; 1972.* (44 references) (Polish)

The population of hares in the Poznan area was investigated with particular reference to agricultural application of organochlorine insecticides and the residues of these insecticides in the hares. The mean annual DDT residue level in hare fat is negligible, 0.92 ppm. Residue levels were not correlated with anatomic or pathological changes or with alterations in reproductive patterns. When residue levels were compared for six biocenoses representing various geophysical and natural types, slight differences were seen (0.43 ppm DDT in fat of hares in forest areas, 0.50 ppm in agricultural areas). Seasonal changes in pesticide residues were also slight. Lindane was detected, in very small quantities, in only 22% of the animals examined and only during the summer and fall. Lindane was not detected in young animals, indicating that it degrades much more rapidly than DDT. Methoxychlor, the third component of the widely used Tritox (with DDT and lindane) was not detected by gas chromatography. No evidence was found for a relationship between agircultural application of Tritox and any decrease in population of hares.

74-2342. Korte, F.; Klein, W.; Suess, H.; Siegmund, H. (Inst. fuer Oekologische Chemie, Gesellschaft fuer Strahlen- und Umweltforschung, Schloss Birlinghoven/Siegkreis, Germany). **Investigations of the fate of certain pesticides under biotic and abiotic conditions using tracer techniques.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 35-45.*

The persistence and degradation of monolinuron, pyrazon, and simazine were studied in different soils by measuring $^{14}CO_2$ release from the differently labeled herbicides. Even after three extractions, about 50% of the simazine and greater than 10% of the pyrazon and monolinuron remained adsorbed onto untreated peat. During one vegetation period, 20%, 9%, and 16% of the adsorbed monolinuron, simazine, and pyrazon, respectively, were translocated into cereals. In tests of ^{14}C-labeled aldrin on sugar beets, highest total residues (nearly 0.7 ppm in Germany and 0.45 ppm in England) and highest residues in the form of metabolites (0.15 ppm in Germany and 0.20 ppm in England) were found in the peels. Total residues of peeled beets and leaves were about 0.06 ppm, 80% of which was in the form of metabolites. Dihydrochlordene dicarboxylic acid amounts to about 20% of the total residues in potatoes and about 40% in maize leaves under the climatic conditions of Germany.

74-2343. Disney, R. W.; Fowler, K. S. (Min. Agr., Fisheries and Food, Pest Infestation Control Laboratory, Slough, Buckinghamshire, England). **Residues in cereals exposed to hydrogen phosphide.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 99-101.* (7 references)

Fumigation of weighed whole Manitoba wheat samples with ^{32}P-phosphine followed by exhaustive removal of excess phosphine allowed counting of the non-volatile phosphorus residues, which were still present after prolonged aeration. As the grain moisture content increased from 10.0 to 19.7% wet weight, the residue increased from 1.2 to 7.3 ppm phosphorus. Residue levels increased as exposure time increased. As phosphine concentration increased from 0.48 to 5.5 mg/l. residue increased from 1.0 to 4.1 ppm phosphorus. Autoradiographs of sections of whole wheat showed highest accumulation in the outer layers and in the crease. Grinding of the grain results in greatly increased residue levels.

74-2344. Huque, H. (Department of Plant Protection, Government of Pakistan, Karachi, Pakistan). **Preliminary report on the residues of carbaryl granules in rice plants.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 107-109.*

10% ^{14}C-Carbaryl was applied to rice plants at the rate of 2 lb/acre. Carbaryl residues were separated from plant tissue samples, excluding roots, by TLC using hexane:benzene (1:4) as the mobile phase, and determined by radioassay. Carbaryl residues three days after application were 110.0 ppm, decreasing to 14.8 ppm at 18 days.

74-2345. Suess, A.; Siegmund, H.; Eben, C.; Grampp, B. (Bayerische Landesanstalt fuer Bodenkultur, Pflanzenbau und Pflanzenschutz, Munich, Germany). **Reactions of herbicides with soil and plants.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 111-121.* (2 references)

^{14}C-Labeled monolinuron, pyrazon and simazine were tested on 3 soils differing in pH, total carbon content, nitrogen, calcium, and cation exchange capacity. Initiation of simazine degradation began quickly. After a year, about 12, 18, and 23% had degraded in the three different soils. The rate was fairly high during the first 10 weeks and decreased steadily thereafter. The difference in degradation intensity of pyrazon varied greatly with soil type, in each case beginning after a lag time of about ten weeks, with 3, 8, and 17% degraded at the end of a year. Monolinuron degradation began quickly, increasing at 5 weeks. At a year, about 33, 40 and 45% had degraded in the 3 different soils. Monolinuron apparently reacts with soil components, leaving a small amount to be degraded by *Bacillus sphaericus*, which is responsible for the production of $^{14}CO_2$ from the urea group. About 50% of applied simazine was adsorbed by peat, compared to about 10% of pyrazon and monolinuron. Mustard plants take up about 6% of the soil-adsorbed monolinuron by 24 days, maximum uptake occurring in plants grown on the soil with 60% of the maximum water holding capacity.

74-2346. Bosi, F.; Constantini, F.; Grandi, A. (Ist. Zoocolt. Zool. Gen., Univ. Perugia, Italy). **Determinazione dei pesticidi organo-clorurati nei tessuti di alcune specie avicole e del coniglio. [Determinations of organochlorine pesticides in tissues of some species of birds and in rabbit.]** *Rass. Chim. 25(1): 31-40; 1973.* (10 references) (Italian)

Organochlorine pesticides are used on a large scale, and the danger of residues being accumulated in the tissues of non-target animals is a problem. Residues of the pesticides were determined in 53 animals in liver, fat, and kidneys. The method used was gas liquid chromatography. Pesticides found most often were *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD, BHC, lindane, aldrin, heptachlor, heptachlor epoxide, and dieldrin. The highest amounts of pesticides were found in the tissues of pheasant. The values were lowest in rabbits. The research showed that the amount of pesticide retained in tissues, fat and liver differ with the species in which the capacity of degradation, the metabolism, and the reproduction and growth differs.

74-2347. Mansell, R. S.; Wheeler, W. B.; Elliott, L.; Shaurette, M. (Dept. Soil. Sci., IFAS, Gainesville, FL). **Movement of acarol and terbacil pesticides during displacement through columns of Wabasso fine sand.** *Soil Crop Sci. Soc. Fla. 31: 239-243; 1972.* (9 references)

Aqueous solutions of ^{14}C labeled acarol miticide and terbacil herbicide were displaced through 30 cm columns of Wabasso fine sand taken from profile depths of 0-10 cm and 33-76 cm. The pesticides were applied to each column when the soil was air dried and when it had been saturated with water. Each application involved a solution volume of 25 ml and solute concentrations of 1 ppm pesticide and 3.3 ppm ^{36}Cl as $Na^{36}Cl$. Liquid scintillation measurements of ^{14}C and ^{36}Cl at specific intervals were used to construct breakthrough (elution) curves for each solute. Analysis of these curves indicated that the relative mobilities of the solutes in Wabasso fine sand were in the order: $^{36}Cl > terbacil > acarol$. Only negligible acarol movement was observed for each column displacement.

74-2348. Hornsby, A. G.; Davidson, J. M. (Environ. Protect. Ag., P.O. Box 1198, Ada, OK). **Solution and adsorbed fluometuron concentration distribution in a water-saturated soil: experimental and predicted evaluation.** *Soil Sci. Soc. Amer. Proc. 37(6): 823-838; 1973.* (12 references)

A technique is described for measuring the solution and adsorbed phases of fluometuron in water-saturated soil columns. The data reveals that at an average pore-water velocity of 5.5 cm/hour, the solution and adsorbed phases of fluometuron are not in equilibrium, whereas at the 0.59 cm/hour velocity they were in equilibrium. The kinetic rate equations for adsorption and desorption were not significantly better than the equilibrium model when describing the fast displacement of fluometuron through soils. The desorption distribution coefficient was found to be a function of the maximum amount of herbicide adsorbed prior to desorption. The experimental data was reasonably well described by the mathematical model. (Author abstract by permission)

74-2349. Mestres, R.; Duboul-Razavet, C.; Long, B. (Laboratoire de Chimie appliquee a l'expertise, Faculte de Pharmacie, Montpellier, France). **Presence de micropolluants de la classe des organochlores dans les sediments d'une vaiere littorale: Le Fier d'Ars. [Presence of organochlorine micropollutants in the sediments from the Island of Re.]** *Trav. Soc. Pharm. Montpellier 34(1): 79-90; 1974.* (6 references) (French)

Sand and mud sediment samples taken from different depths on and around the Island of Re off France were analyzed for organochlorine micropollutants by gas chromatography. The only persistent pesticide which had been used in this area was DDT. Residues of PCBs were detected in samples taken from depths of up to 180 cm, which, at a rate of sedimentation of 0.5 cm/year, might suggest the age of the sediment to be about 300 years, were it not due to migration of the PCB residues in the soil. Also, the PCB residues were higher in deeper soil layers than in the surface layer.

Unidentified organochlorine pesticide residues, probably those of dieldrin, were detected on three sampling sites at depths of 15-20 cm, 0.5 cm, and 65-75 cm.

74-2350. Eschenbruch, R.; Kleynhans, P. H. (Oenological Viticultural Res. Inst., Stellenbosch, South Africa). **The influence of copper-containing fungicides on the copper content of grape juice and on hydrogen sulphide formation.** *Vitis 12(4): 320-324; 1974.* (11 references)

Vitis vinifera cv. Pinotage was treated with copper oxychloride before blossoming and with Bordeaux mixture (copper oxychloride; 10% active ingredient, 7 kg/450 liters), copper oxychloride (50% active ingredient, 2 kg/450 liters), and copper oxychloride + zineb (37 + 20% active ingredient, 1 kg/450 ml) after blossoming. The copper content in the grape juice was increased 2-4 times after treatment with copper oxychloride, 2 times after treatment with Bordeaux mixture, and not at all after treatment with copper oxychloride + zineb. The formation of H_2S after fermentation was higher in the samples which had had elevated copper levels. The results indicate that application of copper sprays to grape vines after blossoming should be reconsidered.

74-2351. Shtenberg, A. I.; Bogomolova, Z. N. (Lab. Pesticides Toxicology, Inst. Nutrition of the USSR Acad. Med. Sci., Moscow, USSR). **O differentsirovannom izuchenii i gigiyenicheskom znachenii ostatkov pestitsidov v syrykh i kulinarno obrabotannykh produktakh pitaniya. [Differential study and hygienic signficance of residual pesticides in raw and prepared food products.]** *Vop. Pitan. 1: 69-74; 1974.* (14 references) (Russian)

The problems of assessing the actual hazards of contamination of human food by pesticide residues are discussed, and related studies and analyses are reviewed. When pesticide contents in farm products are determined, measures for reducing the contamination can be taken, but the determinations do not truly reflect the actual contamination of the food consumed. Cleaning, washing, and cooking preparation of foods more or less decrease the pesticide residues. Daily food rations or individual parts thereof should be analyzed to determine the actual hazards of pesticide contamination in foods. Geography and climatic conditions of the sampling area influence the pesticide levels in food products produced there. High DDT levels in prepared food may be due to the use of animal fats rather than oil during preparation. Residue analyses of foods should also cover metabolites, especially of organochlorine pesticides.

74-2352. Horowitz, M.; Blumenfeld, T.; Herzlinger, G.; Hulin, N. (Div. Weed Res., Agr. Res. Org., Newe Ya'ar Exp. Sta., P.O. Haifa, Israel). **Effects of repeated application of ten soil-active herbicides on weed population, residue accumulation and nitrification.** *Weed Res. 14(2): 97-109; 1974.* (51 references)

Ten herbicides, bromacil, chlorthal-dimethyl, diphenamid, diuron, fluometuron, neburon, prometryne, pyrazon, simazine, and trifluralin at two doses were repeatedly sprayed, in autumn and in spring, for 4 consecutive years on non-cultivated, sprinkler-irrigated field plots. Soil samples were taken 5 months after each application and bioassayed. Phytotoxic residues were detected beneath the disturbed top-soil from bromacil, diuron, fluometuron and simazine after the first application, and from neburon after the second application; residues from trifluralin were found in the top-soil only after the fifth application. After the seventh spraying, residues of bromacil were found in the 45-60-cm soil layer. Ammonia content in soil samples taken from treated plots after the fourth, sixth and seventh application was generally similar to the untreated control. In these samples, nitrate content appeared to be correlated negatively with remaining weed number; the control thus contained less nitrate than efficient herbicidal treatments. Soil samples taken after the seventh application of bromacil, diuron, fluometuron, neburon and simazine, which contained appreciable residual concentrations, did not show significant differences from control, in an in vitro nitrification test. (Author abstract by permission, abridged)

74-2353. Lay, M. M.; Ilnicki, R. D. (Dept. of Soils and Crops, Rutgers Univ., New Brunswick, NJ 08903). **Peroxidase activity and propanil degradation in soil.** *Weed Res. 14(2): 111-113; 1974.* (6 references)

The herbicide *N*-(3,4-dichlorophenyl)-propionamide (propanil) and a metabolite of propanil, 3,4-dichloroaniline (DCA), were mixed with Nixon loam soil which was subjected to moisture and air-drying treatments. Degradation of propanil was altered by subjecting the treated soil samples to storage conditions of moisture, drying and chloroform. The peroxidase activity in fresh soil was very low when soil samples were collected during the cold season. The amount of 3,3',4,4'-tetrachloroazobenzene (TCAB) produced from DCA increased with a simultaneous increase in the peroxidase activity in preincubated soil where carbon and nitrogen sources were added. (Author abstract by permission)

74-2354. Hiltbold, A. E.; Hajek, B. F.; Buchanan, G. A. (Dept. Agron. and Soils, Auburn Univ. Agr. Exp. Sta., Auburn, AL 36830). **Distribution of arsenic in soil profiles after repeated applications of MSMA.** *Weed Sci. 22(3): 272-275; 1974.* (12 references)

Arsenic as MSMA (monosodium methanearsonate) was applied to three soil types over a 6-year period. Percentage recovery of applied arsenic averaged 67, 57, and 39% in Hartsells fine sandy loam, Decatur silt loam, and Dothan loamy sand soils, repectively. Essentially all

of the arsenic recovered in the soils occurred in the plow layer with no evidence of leaching into deeper zones. Batch-equilibrium and soil-column studies in the laboratory indicated that the rate of MSMA movement through the surface horizon would be fastest in Dothan loamy sand and slowest in Decatur silt loam. (Author abstract by permission)

74-2355. Best, J. A.; Weber, J. B. (Velsicol Chem. Corp., W. Des Moines, IA). **Disappearance of *s*-triazines as affected by soil pH using a balance-sheet approach.** *Weed Sci. 22(4): 364-373; 1974.* (42 references)

The effect of soil pH on the disappearance of ^{14}C ring-labeled atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-*s*-triazine], hydroxyatrazine [2-hydroxy-4-(ethylamino)-6-(isopropylamino)-*s*-triazine], and prometryne [2,4-bis(isopropylamino)-6-(methylthio)-*s*-triazine] were studied over a 5-month period in a Bladen silt loam soil under greenhouse conditions. Employment of an integrated system allowed simultaneous monitoring of degradation, volatilization, respiration, plant uptake, and leaching processes. A resulting balance-sheet indicated that a range of 87 to 99% of the ^{14}C added could be accounted for after 5 months. Degradation was found to be the primary mode of dissipation. The pattern of atrazine degradation was characteristic of nonbiological processes, while prometryne degradation was probably by microbial action. Hydroxyatrazine was the major metabolite from the atrazine treatments while prometryne yielded an unknown and hydroxypropazine [2-hydroxy-4,6-bis(isopropylamino)-*s*-triazine]. Extractable atrazine after 5 months amounted to 35% of the initial amount added in the pH 7.5 soil and 11% in the pH 5.5 soil, while prometryne occurred as 10% in the pH 7.5 soil and 42% in the pH 5.5 soil. Plant uptake and leaching occurred to a greater extent in the more alkaline soil with each chemical, but these pathways along with volatilization and respiration were minor contributors toward the disappearance of these herbicides. (Author abstract by permission)

74-2356. Burnside, O. C. (Dept. Agron., Univ. Nebraska, Lincoln, NB 68503). **Trifluralin dissipation in soil following repeated annual application.** *Weed Sci. 22(4): 374-377; 1974.* (16 references)

Soil residues from annual trifluralin (*α,α,α*-trifluoro-2,6-dinitro-*N,N* dipropyl-*p*-toluidine) applications were determined over a 4-year period on a Sharpsburg silty clay loam at Lincoln, Nebraska. A phytotoxic residue of trifluralin persisted in the soil for one or more years especially at above-normal rates of trifluralin. Repeated applications of trifluralin did not cause a significant buildup of trifluralin in the soil. There was little herbicide remaining in the soil during subsequent years from normal rates of trifluralin. (Author abstract by permission)

74-2357. Shilova, S. A.; Denisova, A. V.; Sedykh, E. L.; Efron, K. M. (All-Union Sci. Res. Inst. Disinfection and Sterilization, USSR Min. Pub. Health, Moscow, USSR). **O posledstviyakh primeneniya insektitsidov v subarktike. [Aftereffects of insecticide treatment in the subarctics.]** *Zool. Zh. 52(7): 1008-1012; 1973.* (24 references) (Russian)

The distribution and accumulation of carbaryl in the flora, fauna, and soil in subarctic tundra was studied one month after a single aerochemical application of carbaryl at 5 mg/hr for mosquito control over a 70 ha area. The average carbaryl concentrations in the upper and lower soil layers, *Cladonia* spp., *Betula nana, Salix* sp., and *Eriophorum* sp. were 0.1, 0, 0.5-0.6, 0.4, and 0.7 mg/kg. At the same time, the carbaryl concentrations in *Eisenia nordenskioldi* averaged 2.4 mg/kg. Muscles of birds such as *Charadrius apricarius, Philomachus pugnax, Gallinago gallinago, Tringa glareola,* and *Acanthis hornemannii* contained an average of 1.5 mg carbaryl per kg of body weight. Liver samples from male, female, and sexually immature specimens of *Lemmus obensis* contained 1.1, 1.8, and 12 mg carbaryl per kg. The carbaryl levels determined in testes, uteri, and embryos of this species were 10, 3, and 5 mg/kg. The findings are indicative of the accumulation of carbaryl residues through the successive trophic chains. The *Eisenia nordenskioldi* population was reduced up to 73% in two years.

See also 74-2390 74-2518

74-2358. Radimer, G. F.; Davis, J. H.; Ackerman, A. B.* (562 First Ave., New York, NY 10016). **Fumigant-induced toxic epidermal necrolysis.** *Arch. Dermatol. 110(1): 103-104; 1974.* (6 references)

Acrylonitrile is widely used in Florida as a pesticide in homes. Four cases are reported in which toxic epidermal necrolysis developed 11-21 days after patients returned to houses fumigated with a 2:1 mixture of carbon tetrachloride and acrylonitrile. Patients were hospitalized with blisters covering almost the entire skin surface and mucous membranes. Administration of antibiotics, corticosteriods, fluids, and electrolytes produced no improvement in the three adult female patients. These three patients died of septic shock and gastrointestinal hemorrhage 3-4 weeks after exposure. The ten-year-old son of one of these patients developed widespread pruritic eruptions, but survived with topical and parenteral corticosteroid application. Acrylonitrile is implicated as the causative agent on the basis of previously reported dermal effects following industrial use of acrylonitrile.

74-2359. Cattle, D. S. (Dept. Med., Harare Hosp., Harare, Ethiopia). **A case of organo-phosphorus poisoning.** *Cent. Afr. J. Med. 19(3): 52-54; 1973.* (4 references)

A 28-year-old gardener was admitted to the hospital in a stuporous and dehydrated state and sweating profusely. He was hypothermic, showed signs of respiratory obstruction, and had attacks of uncontrollable shivering. His pupils were pin-point in size and non-reactive to light, and he was very weak. His condition remained unchanged despite rehydration with intravenous fluids and frequent pharyngeal suction. After finding out that the patient had been in contact with an organophosphorus insecticide weekly for the past nine months, a program involving the i.v. administration of pralidoxime and atropine was initiated. Over the next 40 hours the patient remained very ill and drowsy with profuse diarrhea, abdominal pain, and hallucinations. After this the recovery was good. Cholinesterase activity, which was markedly depleted on admission, remained depleted at the time of discharge three weeks later. Although severe organophosphorus poisoning is rare, the prognosis is good. The dangers of the insecticides are well advertised, but it might be advisable to exercise more control over the availability of these substances.

74-2360. Nelson, D. L. (Toxicol. Sect., Chemagro Div. of Baychem Corp., Kansas City, MO). **Evaluation of the safety of agricultural chemicals.** *Clin. Toxicol. 7(2): 141-144; 1974.* (6 references)

Risk or safety associated with a product's use cannot be predicted from a single toxicity value. Toxicity values from several routes of administration under standardized conditions and considerations of the way that the product is used are necessary. The most common route of exposure to agricultural chemicals is dermal; inhalation and oral exposure are less common. Compounds that are highly toxic by the oral route and only moderately toxic by the dermal route have a good record of safe use. On the other hand, some compounds that are highly toxic by both the oral and dermal route do not have as safe a history. Inhalation is secondary in importance to the dermal route as far as exposure is concerned. Oral exposure becomes important only when one considers the possible ingestion by children. When one compares toxicity data of two compounds, there are several factors to consider. The actual data should be from studies on the formulation rather than only on the active ingredient. Some of the important test considerations are species, sex, and age of animals used, as well as the excipient used to apply the dose. All of the above factors can contribute to the degree of toxicity of any given compound or its formulation. (Author abstract by permission)

74-2361. Gruender, H. D. (Klinik fuer Rinderkrankheiten, Tierarztliche Hochschule, Hanover, Germany). **Differentialdiagnose der Fluorvergiftung beim Rind. [Differential diagnosis of bovine fluorosis.]** *Deut. Tieraerztl. Wochenschr. 80(19): 451-458; 1973.* (30 references) (German)

Possibilities of the differential diagnosis of fluorosis, and symptoms of acute and chronic poisoning with fluorine compounds in cattle are described. Fluoroacetates like sodium fluoroacetate and fluoroacetamide, used as pesticides, are converted into fluorocitric acid in the body, and block the tricarboxylic acid cycle by inhibiting the aconitase activity. They may be lethal as powerful nerve and heart poisons. Most of the quantity of fluoroacetates ingested is eliminated in the feces and urine. The minimum lethal dose following single oral administration was 0.9 mg/kg body weight. Subacute lethal poisoning is characterized by such symptoms as anorexia, tachypnea, tachycardia, and generalized clonic-tonic spasms. Anorexia, polypnea, tachycardia, and edema in the throat were diagnosed after poisoning with sublethal doses of fluoroacetates. Such poisonings can be diagnosed by the increased citric acid levels in all organs or by determination of the aconitase activity.

74-2362. Butow, C. H. (West German Embassy, Tokyo, Japan). **Verdicts on lawsuits involving environmental questions in Japan.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 254-257.*

Minamata disease was caused by the discharge of waste materials containing mercury into the River Agano. The courts realized that the plaintiffs were hardly prepared to produce complete scientific evidence that the accused company had been responsible for the discharge. The burden of proof was thus put on the

company which had to show it had not caused the damage. Since the evidence could not be provided, the court ordered the company to make reparations to the injured parties. The courts also ordered reparations paid to the plaintiffs in the case of itai-itai disease. The company had been responsible for dumping cadmium-containing waste into the Jinzu River resulting in contamination of the local water used for drinking, fishing, and food preparation. Although there was no definitive proof that the dumping of the cadmium waste had caused the particular illness, the relationship between cadmium and the disease is well established and the reason the court decided in favor of the plaintiff. It is likely the company will appeal the decision to the Supreme Court in Tokyo.

74-2363. Ishikura, H. (Science and Technology Agency, Tokyo, Japan). **Impact of pesticide use on the Japanese environment.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 1-32.* (14 references)

The small amount of land available for farming in Japan necessitates extensive use of insecticides to sustain high yields. However, the education of large numbers of farmers to rational and safe use of these pesticides proved so difficult that many adverse effects of pesticide use were experienced. During 1960-1965 pesticide production doubled. However, public concern over contamination of food and the natural environment forced production from 1965 to 1970 to increase by only 1.7-fold. Parathion, after it caused more than 7,000 cases of human intoxication with 1,600 cases of attempt suicide in 5 years, was replaced with safer organophosphorus compounds. Some species developed resistance to a number of compounds. In other cases, effective destruction of the predatory species of specific pests upset the balance of nature, and these pests then became serious problems. Pesticide usage has also reduced a number of non-target species, adversely affected aquatic organisms and wildlife, contaminated human food and bodies, and contaminated soils in which future crops are to be grown.

74-2364. Menzie, C. M. (Office Environ. Quality, Bureau of Sport Fisheries and Wildlife, U.S. Dept. Interior, Washington, DC). **Effects of pesticides on fish and wildlife.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 487-500.* (32 references)

Of all pesticides, it is likely that organochlorine compounds pose the most serious threat to fish and wildlife. Their great persistence permits their accumulation and magnification. Through biological magnification various species of birds and some fish have been able to accumulate sufficiently large levels of pesticides so as to threaten their survival, and some colonies of birds can no longer sustain themselves. Downward population trends have been noted. Similar observations have been noted in fish. Monitoring programs are in effect which will determine if recent efforts to reverse these trends are sufficient or if it is too late to do so.

74-2365. Zielhuis, R. L. (Coronel Lab., Fac. Med., Univ. Amsterdam, Amsterdam, The Netherlands). **Permissible limits for occupational exposure to toxic agents. A discussion on differences in approach between US and USSR.** *Int. Arch. Arbeitsmed. 33(1): 1-13; 1974.* (25 references)

Differences in the approaches of the United States and Soviet Union in setting permissible limits for respiratory exposure to chemical agents in industry are discussed. In the U.S. dose-response relationships are determined by studying cells and organs, while in the USSR these relationships are determined by studying entire organisms with emphasis on central nervous control. Decisions regarding the acceptability of certain levels of exposure are determined by the different interpretations of biological changes in regard to "health." The exchange of basic data should be promoted; this would be more effective in promoting mutual understanding than would trying to impose one's own interpretations on others. Ultimate agreement on decisions regarding tolerance limits is not a matter of negotiation: it will result only from reasoning based on facts.

74-2366. Amin-Zaki, L.; Elhassani, S.; Majeed, M. A.; Clarkson, T. W.;* Doherty, R. A.; Greenwood, M. R. (Dept. of Radiation Biol. and Biophysics, Univ. of Rochester Sch. of Med., Rochester, NY 14642). **Studies of infants postnatally exposed to methylmercury.** *J. Pediat. 85(1): 81-84; 1974.* (5 references)

The ingestion of bread made from wheat treated with a methylmercury fungicide resulted in an outbreak of methylmercury poisoning in Iraq in the winter and spring of 1971-1972. The transmission of mercury to infants via mothers' milk was investigated in infants born before the contaminated bread was prepared. Mercury concentrations in the maternal blood declined at a rate equivalent to a half-time of 20-30 days, while the concentrations in the infant blood and maternal milk declined at a rate equivalent to a half-time of approximately 70 days. When the first samples were collected, the concentration of mercury in the infant blood was approximately one half that in the maternal blood. Within six months the concentrations were equal, and afterward the concentrations were higher in the infant blood. When the mother receives substantial exposure to methylmercury, suckling infants may develop blood levels of methylmercury greater than the minimum toxic level (200 ppb) for adults. Four infants had levels above 1000 ppb, and one had levels above 1500 ppb. In most cases the hematocrits of the infants and mothers were normal or below normal. The infants exhibited no clinical signs of poisoning.

74-2367. Jouglard, J.; Poyen, B.; Airaudo, C. B.; Levy, P.; Grigorian, G.; Michel, D.; Attali, M.; Botta, A.; Galland, M. C.; Gruny, D.; Negre, F.; Rodor, F. (Centre Anti-Poisons, Hopital Salvator, Marseilles, France). **Le Centre anti-poisons de Marseille. Bilan d'activite 1971. [Antipoison Center of Marseilles. Outline of activities 1971.]** *Marseille Med. 109(9): 527-536; 1972.* (French)

The 1971 activity of the Antipoison Center in Marseilles, located in a hospital, is described. Telephone service, emergency care, psychiatric consultation, toxicological analyses, therapeutic accidents, environmental pollution, prevention of poisonings, and scientific publications are the major fields of activity of the Antipoison Center. Suicide attempts, especially in females, made up 47% of all cases of poisoning. A mortality rate of 1% was established for the 3,092 cases of poisoning in adults and for the 1,368 cases of poisoning in children. The deaths were due to poisoning with organophosphorus insecticides in general and paraquat in particular in some of the cases. Six cases of death due to insecticides, 1 case due to paraquat, 11 cases due to rodenticides with anticoagulant effect, and 1 case due to zinc phosphide were established. Systematic pesticide residue analyses in food products and water are being conducted in cooperation with other institutions and laboratories.

74-2368. Daunderer, M. (I. Med. Abt., Krankenhaus Muenchen-Schwabing, Muenchen-Schwabing, Germany). **Akute Intoxikationen (Hausaerztliche und klinische Therapie). [Acute intoxication. Treatment by the hospital and household physician.]** *Med. Klin. (Munich) 68(44): 43; 1973.* (German)

The symptomatology and therapy of acute poisonings with alkyl phosphates, carbamates, coumarin derivatives, indanediones, and dipyridinium are described. Acute poisonings by alkylphosphates are characterized by such symptoms as miosis, hypersalivation, abdominal spasms, diarrhea, bradycardia, irritation, muscular fibrillation, dyspnea, cyanosis, clonic-tonic spasms, unconsciousness, final mydriasis, pulmonary edema, and asphyxiation. For therapy, immediate administration of 5-10 mg atropine, pralidoxime, gastric lavage, and repeated administration of atropine and pralidoxime depending on the evolution of the symptoms are required. Carbamates produce the same symptoms as alkylphosphates, but pralidoxime is not administered in their therapy. Repeated intake of coumarin derivatives causes cerebral hemorrhage, hematuria, anemia, and shock. Repeated administration of vitamin K1 and blood transfusion are essential for therapy. The dipyridinium derivatives diquat, morpham quat, and paraquat cause gastroenteritis, anuria, fever, psychoses, generalized spasms, skin and gastric hemorrhages, and possible delayed lung edema. Immediate gastric lavage with charcoal and sodium sulfate, forced diuresis, hemodialysis, Auxiloson inhalation, and cortisone administration are required for efficient therapy.

74-2369. Jax, W.; Grabensee, B.; Schroeder, E. (I. Medizinische Klinik, Universitaet Duesseldorf, Duesseldorf, Germany). **Die Therapie der Thalliumvergiftung. [Therapy of thallium poisoning.]** *Med. Welt 24(17): 691-693; 1973.* (9 references) (German)

The therapy of acute thallium poisoning is described on the basis of four cases in middle-aged female patients. Two patients who ingested 9 and 12 mg thallium per kg body weight were taken to the hospital immediately after poisoning; two others were hospitalized 11 and 35 days after intake of unknown quantities of thallium. The therapeutic results indicate the usefulness of gastric lavage with a solution containing colloidal ferrihexacyanoferrate, enema combined with oral administration of colloidal hexacyanoferrate-II for at least 8 days, and forced diuresis to increase urine production to 12-24 liter daily. Additional hemodialysis is indicated in serious cases with high thallium levels in the blood. The rate of thallium elimination was highest in the feces, urine, and dialysate.

74-2370. Sandermann, W. (Universitaet Hamburg, Hamburg, Germany). **Polychlorierte aromatische Verbindungen als Umweltgifte. [Polychlorinated organic compounds as environmental pollutants.]** *Naturwissenschaften 61(5): 207-213; 1974.* (44 references) (German)

Environmental pollution caused by organochlorine fungicides, insecticides, and herbicides and the inherent impurities and metabolites of these chemicals are surveyed. Organochlorine pesticides often contain highly toxic by-products and impurities or can be converted into toxic compounds. Polychlorinated naphthalenes are potential by-products of chloronaphthalene, a widely used wood preservative; they can cause perna disease in man and x disease in cattle. Tetrachlorodibenzodioxin, a breakdown product of 2,4,5-T and probably of pentachlorophenol, is extremely toxic, also causes perna disease, and has teratogenic and probably carcinogenic effects. It may also be formed from 2,4,5-T during pyrolysis and may occur during the burning of wood previously treated with this pesticide. PCBs are stable pollutants and are frequently found in birds, fish, and human food. The wide distribution of PCBs may be due to the use of wood preservatives containing these compounds and conversion of the insecticide DDT.

74-2371. Dacre, J. C.; Scott, D. (Toxicol. Res. Unit, Med. Sch., Univ. Otago, Dunedin, New Zealand). **Effects of dieldrin on brown trout in field and laboratory studies.** *N. Z. J. Mar. Freshwater Res. 7(3): 235-246; 1973.* (20 references)

In September 1963, 55 liters of a solution containing dieldrin was accidentally discharged into the Silver Stream, Otago, New Zealand. The effects on the brown trout (*Salmo trutta* Linn.) and bottom fauna of the stream were determined. All of the trout in the lower

Silver Stream were killed. On the day after the accident fish near the polluted zone were still being affected. Within two days, however, repopulation of the polluted stretch was proceeding without further obvious mortality. The trout population significantly decreased after the accident, but the statistics are complicated by small intermittent discharges of sewage between the date of the accident and the date of the quantitative survey. The dieldrin did not significantly affect the populations of bottom fauna tested. A laboratory investigation determined the LC50 for brown trout as 0.016 ppm. Dieldrin residue levels in the skeletal muscles, liver, and brain were measured by gas-liquid chromatography; the minimum lethal levels of dieldrin in these tissues were 1.0-2.0 ppm.

74-2372. Sharman, J. R.; Taylor, H. W.; Scott, R. D. (Clin. Biochem. Dept., Christchurch Hosp., Christchurch, New Zealand). **Drug overdosages and poisonings in Christchurch during 1971.** *N. Z. Med. J. 76(487): 402-404; 1972.*

During 1971, the Christchurch Hospital in Christchurch, New Zealand treated 533 males and 648 females who had been poisoned or had taken overdoses of drugs. Children under five years of age constituted 53.8% of the total cases, with the second largest group coming from the 20-29-year age bracket. Chemical analyses carried out in 516 persons revealed the presence of pesticides in 1.8% of the cases. In a total of 150 cases no drug or poison was found. In only 8% of the cases submitted to chemical analysis was an unsuspected drug or poison detected, indicating that the information given to the medical staff was generally reliable.

74-2373. Braaksma, S. (Nature-protection Dept., State Forest Serv., Utrecht, The Netherlands). **Some details about the occurrence of bats in summer and winter-resorts in the Netherlands and about the risks caused by wood preservation activities in buildings.** *Biol. Glas. 75(1): 125-128; 1973.* (11 references)

The presence of bats in various churches and other buildings throughout The Netherlands was investigated. Small colonies of 17 species were discovered. Several of these species are declining rapidly, with only two species being sufficiently numerous not to cause concern. One of the chief reasons for the declining numbers of bats is the use of toxic chemicals. Many bats are endangered by feeding on sublethally poisoned insects in man-made woodlands, orchards, and other cultivated areas. Bats are also endangered by the use of pesticides against wood-eating insects and wood-rotting fungi in buildings. Pesticides implicated in poisonings include pentachlorophenol, chlorinated naphthalenes, lindane, and dieldrin. Although very little is known concerning this problem, it is important to reduce the risks to bats in all ways possible.

74-2374. Savina, A. S.; Kiseleva, N. P. (Toxicological Therapy Center, N. V. Sklifosovskiy Sci. Res. Inst. First Aid, USSR). **Izmeneniye miokarda pri otravleniyakh barbituratami i fosfororganicheskimi soyedineniyami (kliniko-morfologicheskiye paralleli). [Changes in the myocardium in poisonings with barbiturates and organophosphorus compounds (clinico-morphological parallels).** *Sov. Med. 36(5): 113-120; 1973.* (19 references) (Russian)

Clinico-electrocardiographic and morphological studies in 45 subjects with acute lethal poisonings by barbiturates (16 subjects) and organophosphorus pesticides (parathion, trichlorfon, and malathion, 29 cases) are described. All poisons were ingested orally. In subjects poisoned by organophosphorus compounds cholinesterase activity was reduced to 0.8-3 μmol/ml·min. Cardiovascular abnormalities predominated in barbiturate poisoning. In poisonings by organophosphorus compounds the clinical symptoms were largely due to the specific cholinergic action of these poisons, leading to sudden cardiac arrest, and pathologically increased electrical systole in addition to diffuse myocardial changes, similar to those observed in the cases of barbiturate poisoning. Extensive necroses and necrobiotic foci in the contractile myocardium were found in subjects poisoned by organophosphates. Serious disturbances in the redox enzyme systems of the myocardium, resulting in damage to the energy-producing and growth processes, were found in both groups.

74-2375. Besemer, A. F. H. (Plant Prot. Serv. Wageningen, The Netherlands). **Pesticides and the fauna, a problem of policy.** *TNO - Nieuws 27(10): 623-6; 1972.* (10 references)

A lack of adequate alternative methods of pest control makes pesticide use in the Netherlands indispensable. The need for careful, justified pesticide management has resulted in a systematic pesticide policy. A pesticide may not be sold, stocked, or used unless authorized by law. Approval will be given if the pesticide is suitable for the purpose for which it is intended and if no unduly harmful side effects on humans or the environment will result. Restrictions have been imposed on the use of aldrin, dieldrin, heptachlor, chlordane, DDT, and organomercury fungicides. The use of pesticides in accordance with internationally defined rules of good agricultural practice is promoted, that is, in minimum necessary quantities and applied to leave the smallest possible residues; these must also be toxicologically acceptable. Biological, chemical, and land management measures should be integrated in a pest control program. Research programs on sterile male techniques for onion flies and other genetic methods are under way.

74-2376. Olmsted, L. L; Cloutman, D. G. (Dept. Zool., Univ. Arkansas, Fayetteville, AR 72701). **Repopulation after a fish kill in Mud Creek, Washington County,**

Arkansas following pesticide pollution. *Trans. Amer. Fish. Soc. 103(1): 79-87; 1974.* (13 references)

In 1971, pollution by an unknown pesticide used in ridding cattle of ticks resulted in a fish kill in Mud Creek, Washington County, Arkansas. About 6000 fish representing 8 families and 29 species were identified from the kill. In general, the dead fish had dark gills, distended bellies, expanded opercula, open mouths, and heads turned upward. Two typically bottom dwelling species were observed swimming at the surface with an apparent loss of equilibrium. Repopulation of the sample area began within five days after the kill. Species richness continued to increase at a fairly constant rate for the next three months. Most of the individuals immigrating into the sample area were young-of-the-year or immature. The reinhabitants are listed and the factors governing their immigration and occurrence discussed.

74-2377. Zograbyan, L. I.; Ayrapetyan, K. A.; Arustamyan, A. N.; Talanov, G. A. (Armenian Sci. Res. Inst. Animal Husbandry and Veterinary, USSR). **Sluchai otravleniya ovets med'soderzhashchimi pestitsidami i DNOKom. [Cases of sheep poisoning by copper-containing pesticides and DNOC.]** *Veterinariya (Moscow) 49(2): 104-105; 1973.* (Russian)

Massive death of sheep was reported after feeding on grass and hay from orchards and vineyards previously treated with copper-containing pesticides and DNOC on several occasions. Depression, anorexia, yellow color of the skin and mucosa, fever, slight tachypnea, tremor of the muscles, enlargement of the liver, kidney, gallbladder, and spleen, and focal hemorrhages in the epicardial, myocardial, and subendocardial regions were diagnosed. The DNOC contents in the blood serum, lungs, kidney, and liver were 7 mg/kg, 6 mg/kg, 5 mg/kg, and 5 mg/kg. In other organs the DNOC levels ranged from 2 to 10 mg/kg. Death occurred long after exposure, preceded by cachexia in most cases. Therapy with ammonium molybdate, hyposulfite, methylene blue and unithiol proved effective in only 10-15% of all cases.

74-2378. Capurso, A.; Morgantini, M. (Ist. Zooprofilact. Sper. Mezzogiorno, Portici, Italy). **Episodio di intossicazione nei vitelli causato da ingestione di dimetilan. [Episode of poisoning in calves caused by the ingestion of dimetilan (2-dimethyl-3-carbamoyl-5-methylpyrazolyl dimethyl carbamate).]** *Vet. Ital. 23(9-10): 526-537; 1972.* (8 references) (Italian)

Although dimetilan is supposed to have low mammalian toxicity, a clinical syndrome appeared following its use in the calf-fattening section of a farm. The animals' growth was retarded, and 15 calves died. Symptoms included gastrointestinal disturbances (diarrhea), dehydration, nervous system disturbances (including dullness and ataxia), general depression, and loss of condition. These disturbances always occurred 2-3 days after the walls of the calves' stalls were painted with a dimetilan mixture. Detection of dimetilan in the feces of the calves at the time when symptoms appeared confirmed the diagnosis. The brief duration of the syndrome (generally 4-5 days) is explained by the rapid elimination of dimetilan and its metabolites from the body.

74-2379. Dunayskiy, V. B. (Vinnitsa District Sanit.-Epidemiol. Station, Vinnitsa, USSR). **Osobennosti techeniya ostrykh intoksikatsiy polikhlorpinenom pri razlichnykh putyakh postupleniya yego v organizm. [Peculiarities of the course of acute intoxications with polychloropinene depending on different routes of its entry into the organism.]** *Vrach. Delo 3: 139-141; 1974.* (6 references) (Russian)

Fourty-three cases of acute poisoning due to inhalation and ingestion and skin contact with polychloropinene are analyzed. The initial symptoms (headache, vertigo, asthenia, and nausea), were common for all routes of entry, and the central nervous system, gastrointestinal tract, and liver were also affected. Following oral intake of polychloropinene, the central nervous system and the gastrointestinal tract were equally involved; with inhalation, lesions of the cardiovascular system prevailed. Following inhalation, remission occurred due to increased polychloropinene concentrations in the air as a result of intensified evaporation in a recently treated field.

See also 74-2294 74-2298 74-2323 74-2417 74-2518

74-2380. Hanker, I. (Radiobiol. Lab., Inst. Plant Protection, Praha-Ruzyne, Czechoslovakia). **Penetration, excretion and metabolism of DDT-^{14}C and the effects of temperature in susceptible and resistant larvae of *Leptinotarsa decemlineata* Say (Coleoptera).** *Acta Entomol. Bohemoslov. 70(4): 243-253; 1973.* (8 references)

The rates of penetration and excretion of DDT-^{14}C were studied in 2nd, 3rd, and 4th instar larvae of the Colorado potato beetle. The differences between susceptible and resistant larvae were not significant except in the 2nd instar larvae in which the pesticide showed somewhat slower penetration. Non-toxic DDE was the main DDT metabolite. Another unidentified metabolite was occasionally found in larval extracts, and another radioactive substance(s) was found in aqueous extracts of the excreta. These metabolites were produced in insignificant quantities. The concentration of the insecticide in the bodies of the resistant larvae was always several times less than in the susceptible individuals.

74-2381. Kneffel, Z.; Desi, I.; Salanki, J. (Inst. Public Health, Budapest, Hungary). **Changes caused by small quantities of dilute aqueous pesticide solutions in the periodic activity of the sphincter of *Anodonta cygnea*.** *Acta. Physiol. Acad. Sci. Hung. 41(3-4): 371; 1972.*

In the resting period, lasting tonic contraction of the adductor muscle of fresh-water and sea shellfish keeps the shells closed for several hours. In the alternating active period, the rhythmic contraction of the muscles is followed by immediate relaxation. The alternating rhythm of the active and resting periods changes with the species and the individual organisms; it is also changed by changes in the composition of the ambient water. Small quantities of the water soluble organic phosphate (Virland, Nuvan, Nexion) and carbamate (Baygon, Nikecid) type pesticides caused periodic activity changes in the sphincter of *Anodonta cygnea*. At concentrations of 0.1 to 1.0 mg per liter, these compounds greatly prolonged the resting period. The rhythmic periodic activity of the sphincter is under the control of cerebral ganglia via cerebro-visceral connections. When these ganglia were treated with cotton wool soaked in pesticides, a change in frequency resulted.

74-2382. Gefferth, G.; Tarjan, R. (Inst. Nutrition, Budapest, Hungary). **Effect of Faltan on hexobarbital metabolism.** *Acta Physiol. Acad. Sci. Hung. 41(3-4): 380; 1972.*

The effect of heterogeneous oxidase on the metabolism of hexobarbital by young and adult animals pretreated with the phthalimide fungicide Faltan was studied by estimating the duration of hexobarbital anesthesia. The effect of phenobarbital on the induction of heterogeneous oxidase was also studied in Faltan-pretreated animals. Faltan prolonged the duration of hexobarbital anesthesia in young animals but did not affect the duration in adults. Faltan did not influence the induction of heterogeneous oxidase by phenobarbital.

74-2383. Frear, D. S.; Hodgson, R. H.; Shimabukuro, R. H.; Still, G. G. (Agr. Res. Serv., U.S. Dept. Agr., Metabolism Radiation Res. Lab., Fargo, ND). **Behavior of herbicides in plants.** *Advan. Agron. 24: 327-378; 1972.* (134 references)

The most recent reports on the metabolism and fate of herbicides in higher plants are discussed. Particular attention is given to the role of metabolism in herbicide selectivity, the need for additional information on the identification and significance of many soluble and insoluble polar metabolites and residues in plants, and the need for basic biochemical studies on the plant enzyme systems responsible for pesticide metabolism. Each class of herbicide is reviewed separately. These classes include: the benzoic acids, dinitroanilines, triazines, heterocyclics, diphenylethers, substituted ureas, carbamates, and anilides.

74-2384. Karanth, N. G. K.; Bhat, S. G.; Vaidyanathan, C. S.; Vasantharajan, V. N. (Microbiol. and Pharmacol. Lab., Indian Inst. Sci., Bangalore 560012, India). **Conversion of Dexon (*p*-dimethylaminobenzenediazo sodium sulfonate) to *N,N*-dimethyl-*p*-phenylenediamine by *Pseudomonas fragi* Bk9.** *Appl. Microbiol. 27(1): 43-46; 1974.* (15 references)

The metabolism of the fungicide Dexon (*p*-dimethylaminobenzenediazo sodium sulfonate) by a soil bacterium is reported for the first time. The organism which is capable of using Dexon only by a co-metabolic process was obtained by enrichment culture and was identified as *Pseudomonas fragi*. The first metabolic product of Dexon was identified as *N,N*-dimethyl-*p*-phenylenediamine. The presence of an enzyme, *p*-dimethylaminobenzenediazo sodium sulfonate reductase, capable of reducing Dexon to *N,N*-dimethyl-*p*-phenylenediamine has been demonstrated in the cell-free extracts of the organism. The enzyme is found to be in the soluble fraction and requires dithiothreitol as a reductant. (Author abstract by permission)

74-2385. Gross, W. B.; Siegel, P. B. (Dept. Vet. Sci., Virginia Polytechnic Inst., Blacksburg, VA 24061). **Effect of social stress and steroids on antibody production.** *Avian Dis. 17: 807-815; 1973.* (14 references)

The effects of social stress, adrenal blocking agents, steroids, and artificial selection for the level of plasma corticosterone following social stressing on the ability of chickens to produce antibodies against *E. coli* "O" antigen were studied. The antibody response was relatively higher under low levels of social stress, low

levels of plasma corticosterone, and the administration of chemicals which block the production of corticosterone by the adrenals. The antibody response was lower under high levels of social stress, high levels of plasma corticosterone, and the administration of steroids such as dexamethasone. Chickens treated with 375 ppm DDD (TDE) for 10 days and exposed to high levels of social stress showed antibody titers similar to those of untreated birds exposed to low levels of social stress.

74-2386. Overstreet, D. H. (Sch. Biol. Sci., Flinders U. South Australia, Bedford Pk., South Australia, Australia). **Reduced behavioral effects of pilocarpine during chronic treatment with DFP.** *Behav. Biol. 11(1): 49-58; 1974.* (24 references)

Male Sprague-Dawley rats were challenged with pilocarpine at several points during a chronic regimen of DFP treatment (0.2 mg/kg/day). Since DFP lowers the activity of brain cholinesterase (ChE) at a slow rate, the pesticide would not be expected to have behavioral effects. Chronic treatment with DFP had no significant effects on the operant behavior of the rats even though their brain ChE activity was reduced to below 30% of the normal limits within nine days. However, pilocarpine significantly reduced the operant responding of the DFP rats within as little as five days; at this point the brain ChE activity was about 40% normal. Mecamylamine depressed the responding of DFP-treated and untreated animals to a similar extent, while atropine depressed the responding of the DFP-treated animals to a greater extent, and carbachol depressed the responding of the untreated animals to a greater extent. Thus, the behavioral effects of cholinergic agents are lowered in DFP-treated animals, and there is a reduction in the sensitivity of postsynaptic cells to acetylcholine.

74-2387. Bus, J. S.; Aust, S. D.; Gibson, J. E. (Dept. Pharmacol., Michigan State Univ., East Lansing, MI 48824). **Superoxide- and singlet oxygen-catalyzed lipid peroxidation as a possible mechanism for paraquat (methyl viologen) toxicity.** *Biochem. Biophys. Res. Commun. 58(3): 749-755; 1974.* (18 references)

Paraquat was reduced by mouse lung microsomes when incubated anaerobically with NADPH. The reaction was inhibited by the addition of antibody to rat liver NADPH-cytochrome c reductase. In the presence of NADPH and NADPH-cytochrome c reductase, paraquat increased the in vitro peroxidation of rat liver microsomal lipid. The peroxidation was inhibited by superoxide dismutase and the singlet oxygen trapping agent 1,3-diphenylisobenzofuran. The data incidates that paraquat toxicity for mammals may be mediated via the formation of superoxide ion through the transfer of a single electron from reduced paraquat to oxygen. Singlet oxygen may form from superoxide and subsequently react with lipids to form fatty acid hydroperoxides.

74-2388. Watabe, T.; Akamatsu, K. (Biochem. Lab., Div. Organic Chem., Tokyo Coll. Pharm., Ueno-sakuragi, Tokyo 110, Japan). **Accumulation of an epoxy intermediate during the hepatic microsomal metabolism of *cis*-stilbene to *threo*-stilbene glycol due to the inhibition of epoxide hydrolase by *trans*-stilbenimine.** *Biochem. Pharmacol. 23(13): 1845-1851; 1974.* (33 references)

Hepatic microsomal epoxide hydrolase catalyzing the conversion of a wide variety of epoxides, including *cis*-stilbene oxide (the model substrate used in the present study), to glycols was inhibited by *trans*-stilbenimine. *cis*-Stilbenimine was less active and polar aziridines such as mitomycin C, ethylenimine, and iminocyclohexane had little effect. The inhibition by *trans*-stilbenimine was competitive, suggesting the identity of epoxide hydrolase with aziridine hydrolase which has previously been shown to catalyze the conversion of aziridines to the corresponding amino-alcohols in the same stercochemical manner as that in the enzymatic hydrolysis of epoxides. Addition of *trans*-stilbenimine to a microsomal reaction system containing NADPH and *cis*-stilbene as the substrate led to the accumulation of the epoxy intermediate *cis*-stilbene oxide with concomitant formation of *threo*-stilbene glycol. The aziridine also inhibited epoxidase and reduced the rates of formation of the *threo*-glycol from *cis*-stilbene and of heptachlor epoxide from heptachlor. (Author abstract by permission, abridged)

74-2389. Locke, R. K.; Mayer, V. W. (Div. Toxicol., Food Drug Admin., Dept. Health, Educ., Welfare, Washington, DC 20204). **Physical evidence for the oxidative demethylation in vitro of 1-naphthyl *N*-methylcarbamate by the Udenfriend chemical hydroxylation system.** *Biochem. Pharmacol. 23(14): 1979-1984; 1974.* (18 references)

1-Naphthyl *N*-methylcarbamate (carbaryl) was oxygenated in the Udenfriend chemical hydroxylation system as modified by Malling (H.V. Malling, *Mutation Res.* 3, 537, 1966). The *N*-methyl oxidation product, 1-naphthyl *N*-(hydroxymethyl)carbamate, and the *N*-demethylation product, 1-naphthyl carbamate, were isolated and identified by mass and/or infrared spectrometry. These results very strongly suggest that the system is, in fact, capable of *N*-methyl oxidation and demethylation. This capability may apply to *N*-alkyl groups in general. (Author abstract by permission)

74-2390. Kozaczenko, H.; Sobieraj, W. (Inst. for the Use of Chemical Substances in Agriculture, Higher School of Agriculture in Olsztyn, Olsztyn, Poland). **Wplyw wilgotnosci gleby na fitotoksycznosc afalonu, aresinu i alipuru oraz ich dzialanie na mikroflore gleby. [Influence of soil moisture on the phytotoxicity of afalon, aresin and alipur and their effect on the soil microflora.]** *Biul. Warzywniczy 14: 161-177; 1973.* (24 references) (Polish)

Experiments were performed in 1967-69 to establish the soil moistures for Afalon (linuron), Aresin, (monolinuron) and Alipur (cycloron plus chlorbufam) which show the highest phytotoxic effects and how they affect the microflora. The soil moisture was adjusted to levels of 65, 55, 45, 35, and 25% of maximum water capacity. The phytotoxicity was tested in pot experiments. Soil samples were also taken from the pots for microbiological investigations by the plate method. At all tested moisture levels the action of the herbicides was not intense for a period of four weeks after application; effects of the herbicides were no longer apparent after 8 weeks. The herbicides at various soil moisture levels changed the populations of the groups of microorganisms investigated. They inhibited most extensively and for the longest time the development of cellulolytic microflora, particularly of the genus *Cytophaga*. The *Azotobacter* population first decreased and then increased, particularly at six and eighteen months after application. The herbicides had no effect on the population of nitrifying bacteria.

74-2391. Logan, J. C. P. (Department of Dermatol., Stobhill General Hospital, Glasgow, Scotland). **Norwegian scabies during immunosuppressive therapy.** *Brit. Med. J. 4: 485; 1973.* (3 references)

The author of this letter reports that repeated application of benzyl benzoate for treatment of Norwegian scabies has been inadequate, and the disease has responded only to prolonged treatment with 10% sulfur ointment. An earlier case report in which there was a prompt and complete response of the disease to 1% gamma-benzene hexachloride (lindane) was surprising.

74-2392. Kopfler, F. C. (U.S. Environ. Protect. Ag., Off. Res. Monit., Gulf Coast Water Supply Res. Lab., Dauphin Inst., AL 36528). **The accumulation of organic and inorganic mercury compounds by the eastern oyster (*Crassostrea virginica*).** *Bull. Environ. Contam. Toxicol. 11(3): 275-280; 1974.* (10 references)

In the first experiment, oysters were subjected to mercury levels of 50 μg/liter at a temperature of between 0 and 10° C and at a flow rate of 1 liter/oyster/hr. Oysters exposed to mercuric chloride concentrated the mercury from 25 mg/kg wet weight in 7 days to 60 mg/kg in 42 days, but suffered no apparent ill effects. Mercury content in gills was 180 mg/kg wet weight. Administration of phenyl- and methylmercury had to be terminated in 19 days since many of the oysters were dead or moribund. Methylmercuric chloride was concentrated from 21 mg/kg in 7 days to 33 mg/kg in 19 days. Phenylmercuric acetate was concentrated from 15 mg/kg to 23 mg/kg in the same time. Concentrations of copper and zinc were depressed in all three groups of oysters one week after exposure to mercury. In a second similar experiment, mercury levels used were 1 μg/liter with water temperature at 25 to 35°, and flow rates of 2 liter/oyster/hour. Over a 74-day exposure, methyl- and phenylmercury were concentrated to about the same degree and inorganic mercury was concentrated about 4 times less. No effect on copper and zinc levels was observed.

74-2393. Lehman, J. W.; Peterle, T. J.; Mills, C. M. (Ohio St. Univ., Dept. Zool., Columbus, OH 43210). **Effects on DDT on bobwhite quail (*Colinus virginianus*) adrenal gland.** *Bull. Environ. Contam. Toxicol. 11(5): 407-414; 1974.* (38 references)

Twenty-eight-day-old quail were maintained for 242 days on diets containing 0, 10, 50, or 150 ppm technical grade DDT dissolved in corn oil. The most common DDT metabolite in the brains of most birds was *p,p'*-DDE, as revealed by gas-liquid chromatography. However, in the birds fed the 150 ppm diet, the most common metabolite was *p,p'*-DDT. The DDE residues gradually increased as a function of the level of DDT in the diet. DDT treatment did not significantly affect adrenal weight, but as the dietary DDT level increased, the cortical/medullary ratio subsequently increased. These results may reflect a hypotrophy of the medullary tissues. A delicate homeostatic balance exists within the avian endocrine system which may be disturbed by feeding sublethal doses of chlorinated hydrocarbon pesticides. This adverse effect on the endocrine system may cause subtle reproductive failures which go unnoticed until the population is greatly reduced.

74-2394. Andrade, P. S. L., Jr.; Wheeler, W. B. (Univ. Florida, Pesticide Res. Lab., IFAS, Gainesville, FL 32611). **Biodegradation of mirex by sewage sludge organisms.** *Bull. Environ. Contam. Toxicol. 11(5): 415-416; 1974.* (3 references)

^{14}C-Mirex (0.1 mg, 1.2 μCi) was incubated for 2.5 months in the dark with 100 ml of sewage sludge under aerobic and anaerobic conditions. The hexane extract was spotted on a silica gel thin layer plate, which was then autoradiographed. The aerobic and control plates showed only one spot of radioactivity, while the anaerobic plates showed two spots. One spot represented undegraded Mirex, while the other represented its metabolites. Thus, under the experimental conditions used, the sewage sludge microbes degraded the Mirex under the anaerobic conditions.

74-2395. Rorke, M. A.; Gardner, D. R.; Greenhalgh, R. (Dept. Biol., Carleton Univ., Ottawa, Ontario, Canada). **Lethality and behavioural symptoms produced by some organophosphorous compounds in the snail (*Helix aspersa*).** *Bull. Environ. Contam. Toxicol. 11(5): 417-424; 1974.* (15 references)

Fresh emulsions of the organophosphorus compounds fenitrothion, fenitro-oxon, and diethylphenylphosphate (DEPP) and of the carbamate physostigmine

sulfate were added directly to the feet of estivating snails (*Helix aspersa*). The LD50 values of these compounds were: 175 μg/g fenitrothion; 140 μg/g fenitro-oxon; 160 μg/g DEPP; and 135 μg/g physostigmine sulfate. All of these compounds in concentrations above 25 μg/g elicited behavioral responses of one or both of the following types: Type 1, snails writhed within their shells and exuded green mucus-like substance; Type 2, snails emerged from shells, antennae drooped, body was flaccid, and muscular coordination was poor. Fenitrothion and DEPP did not inhibit snail blood cholinesterase at concentrations up to 10^{-3} g/ml; fenitro-oxon and physostigmine produced over 90% inhibition at 10^{-4} g/ml. The data indicates that the toxic organophosphorus compounds have more than simply an anticholinesterase effect in *H. aspersa*.

74-2396. Krause, W.; Homola, S. (Dept. Andrology, Fac. Med., Justus Liebig-Univ., Giessen, Germany). **Alterations of the seminiferous epithelium and the Leydig cells of the rat testis after the application of dichlorvos (DDVP).** *Bull. Environ. Contam. Toxicol. 11(5): 429-433; 1974.* (14 references)

Male NMRI/Han mice were given 40 mg/kg dichlorvos in one dose or were given 10 mg/kg/day for a period of 18 days. The testes of the animals were examined histologically on the ninth, eighteenth, twenty-seventh, thirty-sixth, fifty-fourth, and sixty-third days after the beginning of treatment. Both groups of mice showed severe spermiogenetic disturbances which became more distinct with time. Cross-sections of tubules revealed areas of desquamation and decreases in cell population, the number of damaged tubules increasing as the experiment progressed. Larger than normal Leydig complexes were also observed; an increase with time was not noted.

74-2397. Thompson, N. P.; Emerman, R. L. (Pesticide Res. Lab., Food Sci. Dept., Univ. Florida, Gainesville, FL 32601). **Interaction of *p,p'*-DDT with histomoniasis in bobwhites.** *Bull. Environ. Contam. Toxicol. 11(5): 474-482; 1974.* (17 references)

Bobwhites were given orally 0, 0.01, 0.1, 1.0, or 10.0 mg/kg of *p,p'*-DDT every other day for 10 days then treated with 1800 eggs of the nematode, *Heterakis gallinarum*, responsible for spreading histomoniasis. Following egg inoculation, the bobwhites were treated with 15 additional doses of DDT, one every other day. Both liver and cecal lesions were most pronounced in the 10 mg/kg DDT group. Mortality from histomoniasis was highest in the groups fed 1.0 or 10.0 mg/kg doses. Morbidity and mortality from histomoniasis were evident 11 days after infection. Five of the seven birds which died were male. DDT residues increased as a function of the levels fed, but organ residues reached an appreciable amount only in the 10 mg/kg group. At the 10 mg/kg level, diseased birds retained greater amounts of pesticides than nondiseased birds. Egg production was higher among the birds given lower doses of DDT, although nondiseased birds given 10 mg/kg of DDT produced more eggs than any of the other groups. DDT was concentrated in the brain, and smaller amounts were found in the liver and cecum in diseased birds. Total DDT residues in the eggs produced by the treated bobwhites increased in proportion to the doses fed. The data indicates that lowered egg production resulted from the combined effects of histomoniasis and increased levels of DDT and that DDT rendered the birds more susceptible to histomoniasis.

74-2398. Coppage, D. L.; Matthews, E. (U.S. Environ. Protect. Agency, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, FL 32561). **Short-term effects of organophosphate pesticides on cholinesterases of estuarine fishes and pink shrimp.** *Bull. Environ. Contam. Toxicol. 11(5): 483-488; 1974.* (28 references)

The inhibitory effects of lethal environmental concentrations of malathion, guthion, naled, and parathion on brain acetylcholinesterase (AChE) activity were studied in spot (*Leiostomus xanthurus*), pinfish (*Lagodon rhomboides*), Atlantic croakers (*Micropogon undulatus*), sheepshead minnows (*Cyprinodon variegatus*), and pink shrimp (*Penaeus duorarum*). Surviving organisms were assayed in tests in which 40-60% of the test population was killed by the pesticide treatment. AChE inhibition was great in surviving fish and moribund shrimp, the levels of AChE inhibition being relatively constant with the different pesticides and among the various species. The mean brain AChE reductions in the surviving fish varied from 70-96%, and were near or over the "lethal threshold" of about 82%. The lethal threshold probably varies slightly among species. Reductions in the activity of ACh hydrolyzing enzymes in the ventral nerve cords of the moribund shrimp were similar to those observed in the fishes.

74-2399. Cecil, H. C.; Harris, S. J.; Bitman, J. (U.S. Dept. Agr., Agr. Res. Serv., Animal Physiol. and Genetics Inst., Biochem. Lab., Beltsville, MD 20705). **Effects of nonpersistent pesticides on liver weight, lipids and vitamin A of rats and quail.** *Bull. Environ. Contam. Toxicol. 11(6): 496-500; 1974.* (4 references)

Thirty-nine-day old Japanese quail and 21-day-old rats were fed a control diet or one containing 100 ppm methoxychlor, carbaryl, or malathion for two months. Liver weight and lipid of female quail was one and one-half times that of controls with all three pesticides. No change occurred in male quail. Methoxychlor lowered liver weight in male quail. Methoxychlor lowered liver weight and increased liver lipids in male rats, but had no effect in females, while carbaryl and malathion increased liver weight and lowered liver lipids in the female. Carbaryl reduced concentration and total liver Vitamin A content in female quail and rats. Malathion decreased

liver Vitamin A concentration in female rats, but total Vitamin A content remained similar to controls due to increased liver weight. None of the pesticides affected liver Vitamin A in male rats or quail.

74-2400. Somers, J. D.; Moran, E. T., Jr.; Reinhart, B. S. (Dept. of Animal and Poultry Sci., Univ. of Guelph, Guelph, Ontario, Canada). **Effect of external application of pesticides to the fertile egg on hatching success and early chick performance. 3. Consequences of combining 2,4-D with picloram and extremes in contamination.** *Bull. Environ. Contam. Toxicol. 11(6): 511-516; 1974.* (7 references)

Aqueous solutions of 2,4-D alone at recommended dilution and 10 times this value, and in combination with picloram (4:1) at 10 times recommended dilution were sprayed on hens' eggs 24 hours before incubation. Contamination did not lead to adverse effects on incubation performance in either case. In a second experiment, 2,4-D alone was used without pre- or post-embryonic effect. Weight gain of live chicks 3-4 weeks old was improved over controls. Statistical partitioning of this effect showed that it was restricted to males which had been subjected to either of the two levels of 2,4-D alone. There were no apparent effects on feed utilization and mortality. From the second experiment, herbicide recovery from the shell surface paralleled greater application rates used, but the 20-fold increase in 2,4-D amounts used resulted only in a tripling of residues in albumen plus yolk. Biological activity did not assist further amounts of 2,4-D to enter the egg after initial wet contact.

74-2401. St. John, L. E., Jr.; Lisk, D. J. (Pestic. Residue Lab., Dept. of Food Science, New York State College of Agriculture, Cornell University, Ithaca, NY 14850). **Feeding studies with Randox in the dairy cow.** *Bull. Environ. Contam. Toxicol. 11(6): 529-537; 1974.* (2 references)

Randox (CDAA) at 5 ppm was fed for four days to a Holstein cow weighing 478 kg and with a daily milk production of 14.1 kg. Residues of intact Randox were not detected in milk, urine, or feces. Randox was stable during 24 hours of incubation in rumen fluid. However, it was not detectable after 30 minutes in the presence of the beef liver homogenate 10,000 X *g* supernatant fraction. Attempts to detect diallyl amine and 2-chloroacetic acid in the liver fraction after incubation were inconclusive.

74-2402. Stevens, J. T.; Greene, F. E. (Dept. Pharmacol., Milton S. Hershey Med. Cent., Pennsylvania State Univ. Coll. of Med., Hershey, PA 17003). **Alteration of hepatic microsomal metabolism of male mice by certain anticholinesterase insecticides.** *Bull. Environ. Contam. Toxicol. 11(6): 538-544; 1974.* (23 references)

Liver microsomal fractions from adult, male Swiss-Webster mice were added, together with ethyl morphine, to an NADPH-generating reaction mixture. The inhibitory constants of carbaryl, parathion, and disulfoton for ethyl morphine *N*-demethylase activity were determined. Binding constants of these insecticides to cytochrome P-450 were also determined. Binding constants (Ks in μM) for parathion, disulfoton, and carbaryl to cytochrome P-450 were 2.77, 46.50, and 259.43 respectively; maximal spectral changes (ΔAmax) were 0.0066, 0.0056, and 0.0151 respectively. Inhibitory constants (*Ki*) of parathion, disulfoton, and carbaryl for mouse hepatic ethyl morphine *N*-demethylase were 19.6, 175.0, and 246.7. The affinity constants are well correlated with the inhibitory constants, suggesting that the inhibitory effect of these insecticides is associated with their ability to bind cytochrome P-450. Ethyl morphine *N*-demethylase and cytochrome P-450 content were increased to 130 and 131% of the controls, respectively, when mice were exposed in vivo to parathion 48 hours before sacrifice. After three days ethyl morphine metabolism per nMol of cytochrome P-450 was 112, 137, and 89% of controls for parathion, disulfoton, and carbaryl respectively. After five days these values were reduced to 59, 73, and 71%.

74-2403. Stewart, D. J.; Stein, R. A. (Sch. of Natural Resources, Univ. of Michigan, Ann Arbor, MI 48104). **Short-term fate of dietary dieldrin in the digestive tract of juvenile lake trout (*Salvelinus namaycush*).** *Bull. Environ. Contam. Toxicol. 11(6): 563-566; 1974.* (9 references)

Juvenile lake trout were exposed to 700 parts per trillion dieldrin for two weeks. The flesh was removed, macerated, held at 4°C for four hours. Weighed amounts of flesh with dieldrin concentration of 1.05 ± 0.09 ppm were then force-fed to the experimental fish which had been acclimatized for 30 days and then starved for 60 hours in an experimental tank. Stomach and intestinal contents of fish sacrificed at 3, 6, 12, 18, 24, 36, 48, and 60 hours were analyzed for dieldrin. The decline of dieldrin in the stomach paralleled the decline in the amount of food. Little or no dieldrin was recovered in the intestine even after most food had passed into it. This indicated a rapid uptake or degradation of dieldrin in the pyloric caecal region.

74-2404. Wells, M. R.; Phillips, J. B.; Murphy, G. G. (Dept. of Biol., Middle Tennessee State University, Murfreesboro, TN 31730). **ATPase activity in tissues of the map turtle, *Graptemys geographica*, following in vitro treatment with aldrin and dieldrin.** *Bull. Environ. Contam. Toxicol. 11(6): 572-576; 1974.* (7 references)

Portions of the liver, kidney, cloacal bladder, and intestinal mucosa were surgically removed from female map turtles. Activity of (Na^+,K^+,Mg^{++})-dependent ATPase was determined at 21-24° C. Dieldrin or aldrin was

added to aliquots of tissue homogenate to give a pesticide concentration of 53 μM 5.3 μM and 0.53 μM in incubation media containing 20 mM histidine buffer adjusted to pH 7.4, 100 mM NaCl and 20 mM KCl. The reaction was initiated by the addition of 50 μl of 100 mM Na_2 ATP and 100 mM $MgCl_2$. At termination of the reaction, aldrin and dieldrin were extracted from each sample and ATPase activity was determined by measuring the amount of inorganic phosphate produced. Inhibition of (Na^+,K^+,Mg^{++})-dependent ATPase occurred in all tissues at all aldrin concentrations. Inhibition was greatest in intestinal mucosa treated with 53 μM aldrin, and less at lower concentrations. Dieldrin inhibition of ATPase was greater than that of aldrin except in intestinal mucosa. Dieldrin caused the greatest inhibition in the cloacal bladder at 53 μM.

74-2405. Carlson, G. P. (Dept. of Pharmacol. and Toxicol., College of Pharmacy, Univ. of Rhode Island, Kingston, RI 02881). **Epoxidation of aldrin to dieldrin by lobsters.** *Bull. Environ. Contam. Toxicol. 11(6): 577-582, 1974.* (13 references)

Hepatopancreases from male lobsters were removed, homogenized in phosphate buffer (pH 8.0), and centrifuged at 9000 *g* for 20 minutes. The reaction was initiated by adding an aliquot of the 9000 *g* fraction to an incubation medium containing NADPH, glucose-6-phosphate, aldrin, and phosphate buffer. At the termination of the reaction, the *n*-hexane extracted layer was analyzed for dieldrin using gas chromatography and an electron capture detector. At pH 8.0, 1.9 ng dieldrin/mg tissue was formed in 30 minutes. However, at pH 6.0, 7.0, and 9.0, values had dropped to 1.3, 0.9, and 1.1, respectively. The reaction was not very temperature-sensitive; 1.2 and 1.0 ng dieldrin/mg tissue/30 minutes were formed at 20 and 37°, respectively. However, the system was destroyed by boiling.

74-2406. Harrison, J. H.; Mahoney, E. M.; Bennett, A. H. (Dept. Surg., Peter Bent Brigham Hosp., Boston, MA 02115). **Tumors of the adrenal cortex.** *Cancer 32(5): 1227-1235; 1973.* (27 references)

Studies on the causes of hyperadrenocorticism and neoplastic growths in the adrenal cortex have been underway for years, but the causes of these tumors are still unknown. In the past ten years, *o,p'*-DDD (TDE) has been used in treating metastatic carcinomas of the adrenal glands; fair results were achieved in patients, with regression of tumors. Patients still alive after two years of treatment do not show any evidence of disease and do not require supplemental steroid replacement. It has been shown that *o,p'*-DDD markedly decreases the secretion of steroids by the adrenal cortex. Toxic side effects were noted in most patients (anorexia, nausea, vomiting, diarrhea, and cutaneous eruptions) but most of these side effects disappeared upon reducing the dosage of *o,p'*-DDD.

74-2407. Stoner, G. D.; Shimkin, M. B.; Kniazeff, A. J.; Weisburger, J. H.; Weisburger, E. K.; Gori, G. B. (Dept. Community Med., Sch. Med., Univ. California, San Diego, CA 92037). **Test for carcinogenicity of food additives and chemotherapeutic agents by the pulmonary tumor response in strain A mice.** *Cancer Res. 33(11): 3069-3085; 1973.* (22 references)

Forty-one food additives and 20 chemotherapeutic agents were examined for their ability to induce primary lung tumors in male and female A/He mice. In most cases, the animals received i.p. injections of each compound for 8 weeks and were killed 24 weeks after the first injection; with some of the more toxic compounds fewer injections were administered. Two or three dose levels were used for each chemical. Of the 41 food additives, only cinnamyl anthranilate produced pulmonary tumors under the conditions used. Of the 20 chemotherapeutic agents, 12 produced pulmonary tumors, uracil mustard being the most active compound. Thio-TEPA produced 1-5 tumors in 16 of the 20 mice injected with 0.094 g/kg, 1-2 tumors in all of the mice injected with 0.047 g/kg, and 1-2 tumors in 11 of 20 mice injected with 0.019 g/kg.

74-2408. Carnio, J. S.; McQueen, D. J. (Dept. Biol., York Univ., Toronto, Ontario, Canada). **Adverse effects of 15 ppm of *p,p'*-DDT on three generations of Japanese quail.** *Can. J. Zool. 51(12): 1307-1312; 1973.* (17 references)

This study deals with the effects of administering 15 ppm of *p,p'*-DDT in the diet of Japanese quail (*Coturnix coturnix*) over three generations. Four parameters were measured: (1) egg production, (2) egg fertility, (3) number of abnormal eggs produced, and (4) egg residue concentrations. A comparison of first- and third-generation data shows that egg production decreased slightly, fertility and percentage fertility decreased substantially, the production of abnormal eggs increased, and residue concentrations in the eggs increased. The study suggests that the duration of exposure may be as important as the concentration of DDT administered. (Author abstract by permission)

74-2409. Wennerberg, R.; Loefroth, G. (Radiobiol. Dept., Univ. Stockholm, Wallenberg Lab., Stockholm, Sweden). **Formation of 7-methylguanine by dichlorvos in bacteria and mice.** *Chem.-Biol. Interactions 8(5): 339-348; 1974.* (45 references)

The formation of 7-methylguanine was studied in male NMRI mice and *E. coli* strain B following treatment with labeled dichlorvos. Labeled 7-methylguanine was present in both the DNA and RNA of *E. coli* exposed to dichlorvos. The intensity of labeling increased with the dichlorvos treatment time. Following the i.p. injection of dichlorvos into mice, almost 70% of the administered radioactivity was excreted in the urine within the first 24 hours; urinary excretion accounted

for 60% of the administered radioactivity following dichlorvos inhalation. The ratio of the amount of radioactivity excreted on the first and second days was higher for inhalation than for i.p. injection. The radioactivity was associated with 7-methylguanine, which probably originated from the nonenzymatic methylation of guanine moieties. The methylating capability of dichlorvos is less, by a factor of 10 to 100, than that of strongly genotoxic methylating compounds.

74-2410. Prahlad, K. V.; Bancroft, R.; Hanzely, L. (Dept. Biol. Sci., Northern Illinois Univ., DeKalb, IL 60115). **Ultrastructural changes induced by the fungicide ethylenebis (dithiocarbamic acid) disodium salt (nabam) in *Xenopus laevis* tissues during development.** *Cytobios 9(35): 121-130; 1974.* (22 references)

Thirty *Xenopus laevis* embryos with intact jelly coat were placed in 20 ml of a 4 ppm solution of the fungicide ethylenebis (dithiocarbamic acid) disodium salt (nabam). The embryos were then allowed to develop at room temperature for seven days. The nabam had a deleterious effect on the survival of the embryos. Tissues such as the pigmented retina, notochord, and skin showed definite ultrastructural alterations. There was a significant reduction in the melanin content of the pigmented retina of treated individuals and the melanosomes were empty vesicle-like structures. In the notochordal sheath, the collagen fibers were completely disarrayed. Furthermore, the elastic externa was absent and the collagen fibers appeared to be thinner than in the control embryos. There was also a reduction in the pinocytotic plasmalemmal vesicles which are typically seen in the narrow rims of adjacent notochordal cells in normal animals. The dermal basement membrane was narrower in the treated animals and the collagen fibers in the basement lamella of the dermis were reduced and their regular orthogonal arrangement disrupted. This data clearly demonstrates the deleterious effects of nabam on the cells and tissues of a developing system.

74-2411. Turnipseed, G. D. (Mississippi State Univ., State College, MS). **The effects of selected chlorinated hydrocarbon insecticides on *Chlamydomonas reinhardtii*.** *Diss. Abstr. Int. 34(12): 5841B-5842B; 1974.*

This study determined the effects of selected organochlorine insecticides on growth, photosynthesis, and respiration in *Chlamydomonas reinhardtii*. The amount of insecticide concentrated by the organism was also analyzed. It was found that DDT and mirex had no apparent effect on growth as determined by the chlorophyll concentration. Aldrin, dieldrin, endrin, heptachlor, heptachlor epoxide, and toxaphene all had some inhibitory effect on growth in both strains of the algae. Respirometer measurements revealed that both photosynthesis and respiration were inhibited to some degree by all insecticides used except mirex. Photosynthetic measurements were probably more accurate than the respiratory measurements because respiration occurs at a much slower rate; however, there was evidence that indicated the inhibition of respiration by the insecticides. Gas-liquid chromatography data revealed that *Chlamydomonas* adsorbs or absorbs the insecticides. A larger percentage of the insecticide that was recovered was found in the algal extract than was found in the medium extract. Ecologically, the data presented here indicates that the organochlorine insecticides can be harmful. The insecticides, in most cases, proved to be detrimental to algal growth, photosynthesis, and respiration. Also, the fact that *Chlamydomonas* was sorbing quantities of the insecticides indicated the possibility of further magnification of the insecticides at higher trophic levels of the food web. (Author abstract by permission. Copies of the thesis are available from University Microfilms, order No. 74-13,163).

74-2412. Thompson, A. R.; Sans, W. W. (Res. Inst., Can. Dept. Agr., London, Ontario N6A 3KO, Canada). **Effects of soil insecticides in southwestern Ontario on non-target invertebrates: earthworms in pasture.** *Environ. Entomol. 3(2): 305-308; 1974.* (5 references)

One year after treatment of pasture plots with 9 insecticides, there were no statistically significant differences (P=0.05) between numbers of earthworms in treated and untreated plots. Chemical analyses of earthworms obtained 3 weeks after application of the insecticides showed more than 125 ppm of total DDT residues, 22.52 ppm of the sulphone of Dasanit (*O,O*-diethyl *O* (*p*-(methyl sulfinyl) phenyl) phosphorothioate), 9.66 ppm of chlorpyrifos, and 26.33 ppm of Bayer 37289 (*O*, ethyl *O*-(2,4,5-trichlorophenyl) ethyl phosphonothioate). Other residues were negligible. After one year, residues of only DDT and its metabolites were detected in appreciable amounts. (Author abstract by permission)

74-2413. Matsumura, F. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **Metabolism of insecticides in microorganisms and insects.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 96-106.* (56 references)

Chlorinated hydrocarbons are metabolically converted by microorganisms and insects. The most extensively studied aspect of microorganism metabolism of pesticides has been the process of direct reductive dechlorination of DDT. The fact that some variants produce exclusively one or another metabolite of DDT indicates the presence of entirely different metabolic pathways or variations in enzyme systems metabolizing DDT among variants of the same species. The disappearance of BHC has been attributed to the action of soil bacteria. Aldrin and dieldrin undergo epoxidation by soil microorganisms. Chlordane derivatives, organophosphates, and carbamates are degraded by microorganisms. Insects are also important in the metabolic degradation

of pesticides. The most noticeable difference in the two systems of metabolism, i.e., microorganisms vs. insects, is the presence of reductive systems in microorganisms. The presence of a powerful microsomal mixed function oxidase system in animals confers the ability of animals to produce typical oxidation products whereas in microorganisms the formation of hydroxylation products is relatively less common.

74-2414. Brooks, G. T. (Agr. Res. Council, Unit Invertebrate Chem. Physiol., Univ. Sussex, Brighton, England). **Pathways of enzymatic degradation of pesticides.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 106-164.* (302 references)

The present knowledge of the location and nature of enzymes responsible for primary metabolic processes of pesticides such as oxidative, hydrolytic, and reductive conversions, and for secondary processes such as glutathione and other conjugations is reviewed. Most of the available information on conjugation reactions of xenobiotics has been obtained from drug metabolism studies. The nature and consequences of biotransformations are illustrated by using *N*-methylcarbamate insecticides and insecticide synergists, organophosphorus insecticides, and organochlorine pesticides (lindane, DDT, cyclodiene insecticides, and phenoxyacetic acid and anilide herbicides) as examples. Also discussed are some developments from chemical and biochemical investigations, including parameters involved in selective toxicity such as penetration, detoxication, enzyme induction and inhibition, resistance, and synergism.

74-2415. Klein, W. (Inst. fuer oekologische Chemie der Gesellschaft fuer Strahlen-und Umwelfforschung mbH, Munich, Germany). **Metabolism of pesticides in higher plants.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 164-179.* (48 references)

Most of the organic pesticides used in crop protection lead to persistent metabolites which are frequently harmless. However, their effect on environmental quality should be strongly considered. The metabolic behavior of plant protection pesticides in the organisms to which they are applied has been reviewed. Pesticides considered include: chlorinated hydrocarbons like DDT, lindane, aldrin, dieldrin, photodieldrin, isodrin, endrin, heptachlor, trans-chlordane, and endosulfan; other halogenated (non-heterocyclic) compounds like acaricides, phenoxyalkanoic acids, chlorinated aliphatic acids, 2-chloroacetamides, and benzoic acid derivatives; phosphorus compounds like aliphatic phosphorus compounds, phenyl derivatives, and heterocyclic derivatives; carbamates like carbaryl and mesurol (methiocarb); triazines; captan; diquat; and nicotine.

74-2416. Miyamoto, J.; Wakimura, W.; Kadota, T. (Res. Dept., Pesticide Div., Sumitomo Chem. Co., Ltd., Osaka, Japan). **Biodegradation of cyanox, *O,O*-dimethyl-*O*-(4-cyanophenyl)phosphorothionate in rats.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 235-239.*

Cyanox is an insecticidal compound effective against various crop pests and disease-bearing insects. Acute toxicity was low, the oral LD50 to rats being 580 mg/kg and to mice 860 mg/kg. Biodegradation experiments using Wistar rats indicated that the *p*-cyano group of the organophosphorus compound apparently remained intact in the animal body and that biodegradation might have occurred both at the alkyl and at the aryl bond of the molecule. Some portions of the chemical are converted to cyanoxon, toxic in the whole animal. As formation of the demethyl compound from cyanox or cyanoxon is presumed to be catalyzed by glutathione-dependent enzymes, the antidotal effect of reduced glutathione was tested. Glutathione was somewhat effective for reducing toxicity of the compound, especially when applied with atropine or trimethylenepyridine-4-aldoxime methylmorpholine dibromide.

74-2417. Holden, A. V. (Freshwater Fisheries Lab., Pitlochry, Scotland). **Effect of pesticides on fish.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 213-253.* (133 references)

Many pesticides are hydrolyzed or rapidly flushed from the river system, creating only a temporary problem. However, long-term situations in the absence of a mass mortality are difficult to identify and may be more detrimental to fish populations. Long-lasting situations result from applications of chemicals to land as well as to the water itself. Examples of toxicity tests for fish are discussed, and toxicity data for marine fish are reported. The effect of flow of the water, species relationships, period of exposure, hardness of water, physiological condition of the fish, temperature, and size of the fish are all considered in relation to acute toxic effects of the pesticides. Lethal effects of long-term exposure are reviewed, including significance of storage in fatty tissue as it relates to food chain accumulation. Research concerning the susceptibility of different species at different ages is presented. Chronic effects of pesticides include effects on reproduction, effects on behavior, the development of resistant strains, changes in the biochemistry of fish as a direct result of exposure, and physiological effects such as respiratory distress.

74-2418. Kenaga, E. E. (Dow Chem. Co., Midland, MI) **Factors related to bioconcentration of pesticides.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 193-228.* (44 references)

DDT and its stable transformation products persist and become bioconcentrated. The extent of bioconcen-

tration depends on the equilibrium established between absorption of residues on organisms in competition with air, water, and soil absorption; and the redistribution of absorbed pesticides in the tissues of the organisms by ingestion, absorption, metabolism, partitioning, storage, and elimination. Test methods to measure bioconcentration depend on the physical, chemical, and biochemical properties of the pesticide and its transformation products; surface weight relation of treated environmental objects; and consumption rates of various organisms. Standardization of environmental test methods is needed for comparative purposes. Bioconcentration may cause serious ecological problems when the degree of partitioning of a substance or its transformation products from water results in translocation to and storage in critical tissues of the organisms. In many species undergoing constant exposure to widely distributed toxicants, bioconcentration results in high levels of residues. This buildup exceeds the capacities of the organism to metabolize and eliminate the residues. Some of the important properties which result in high bioaccumulation are low water solubility; high fat solubility; high partitioning coefficients from water to environmental components; and high stability under various hydrolytic, light, heat, and microbiological conditions.

74-2419. Miyamoto, J. (Res. Dept., Pesticides Div., Sumitomo Chem. Co., Ltd., Osaka, Japan). **Metabolism of organophosphorus insecticides in plants.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 307-325.* (67 references)

Metabolic pathways of organophosphorus compounds in plants are essentially the same as those in mammals although the importance of each pathway and the amount of intermediary metabolites accumulated may differ with plant species. The only exception is that plants and animals conjugate differently some phenols derived from organophosphorus compounds. In plants, they are conjugated usually as glycosides, whereas in animals they are bound with glucuronic acid and/or sulfate. If compared with organochlorine insecticides, organophosphorus compounds are degraded more rapidly and ultimately to innocuous metabolites. These characteristic properties might ensure the safer use of organophosphorus insecticides for plant protection, causing no serious residue problems.

74-2420. Matsunaka, S. (Nat. Inst. Agr. Sci., Saitama, Japan). **Metabolism of pesticides in higher plants.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 341-364.* (70 references)

Metabolism of pesticides in higher plants occurs by three major reactions: hydrolysis, oxidation-hydroxylation, and conjugation. As an example of hydrolysis of an amide pesticide, the hydrolysis of propanil by rice plants is well known. Hydrolysis of esters is typified by the 2,4-D esters hydrolyzed by extracts from cucumber cotyledons, pumpkin seeds, and corn plants. Hydrolysis of *s*-triazines is seen in the chlorinated *s*-triazine herbicide degradation by corn plants. Oxidation of pesticides includes hydroxylation, beta-oxidation, epoxidation, and sulfur oxidation. Reduction of pesticides in higher plants seems limited to the reduction of the nitro radical on benzene rings. The decarboxylation process has also been studied. *N*-dealkylation is the usual detoxification process of herbicides. In plants this process is found in the metabolism of phenylurea and *s*-triazine herbicides. Conjugation of pesticides in plants can be classified into four groups: sugars, especially glucose; amino acids; peptides; and high molecular compounds.

74-2421. Alexander, M. (Dept. Agronomy, Cornell Univ., Ithaca, NY). **Microbial influence on pesticide degradation.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 365-383.* (19 references)

Microorganisms are frequently the major and sometimes the only means of pesticide elimination from a variety of ecosystems. The fact that a pesticide appears persistent suggests it is intrinsically unsuitable or is unsuitable in the particular region as a substrate for microorganisms. There are refractory molecules from pesticides which fail to be metabolized for one of two general reasons, first, the environment or microenvironment is not conducive to microbial life or the execution of a given degradative reaction, or second, certain chemicals may resist biodegradation under all conditions. It is essential to determine what structural characteristics are correlated with resistance to microbial degradation. Environmental monitoring has shown that cometabolism is an important factor in biodegradation of pesticides. Cometabolism refers to the ability of a microorganism to metabolize a compound which it cannot use for growth. Thus the old assumption that a substrate which is metabolized by a bacterium, actinomycete or fungus must serve as a nutrient source may well be faulty. An attempt was made to isolate a DDT-degrading bacterium based on the idea that cometabolism may be responsible for the apparent persistence of DDT in nature. It was demonstrated for the first time that DDT is essentially completely decomposable by microorganisms.

74-2422. Boush, G. M.; Batterton, J. C. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **Ecological aspects of pesticide-microbial relationships.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 401-422.* (81 references)

Undesirable persistent pesticide residues are widespread in the environment, often in minute amounts in the parts per billion range. Initial residues are subject to movement, concentration, and alteration of chemical structure. They may travel a great distance from their

point of origin, be greatly concentrated through microbial pick-up and food chain passage, and be altered perhaps into a more toxic form. Many pesticides and their metabolites can adversely affect microorganisms either by retarding their growth or photosynthesis. Bacteria which convert ammonia to nitrates are sensitive to aldrin. Cellulose decomposition has been impaired by the effect of chlorpropham on microbes. Respiration of *Azotobacter* sp. has been inhibited by high concentrations of herbicides. Active microbial uptake and accumulation of toxicants has been demonstrated experimentally. Such absorption and concentration through largely unknown mechanisms allows toxicants to reach levels many times above the ambient, thus forming the basis for eventual toxic levels in food chains.

74-2423. Nakatsugawa, T.; Nelson, P. A. (Dept. Forest Entomol., State Univ. Coll. Forestry, Syracuse Univ., Syracuse, NY). **Studies of insecticide detoxication in invertebrates: an enzymological approach to the problem of biological magnification.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972. p. 501-524.* (47 references)

Biological magnification of pesticide residues does not necessarily occur at each step of the trophic chain. Indeed insecticide residues may actually decrease at a higher trophic level. Biological magnification is a balance of intake and elimination of a chemical and is a function of various factors. The role of detoxication enzymes in biological magnification is to increase the polarity of xenobiotics. The detoxication of toxicants in nonarthropod invertebrates has been classed into two phases: the primary phase, usually involving oxidative, reductive, and hydrolytic reactions; and the secondary phase, involving the synthesis of water-soluble conjugates. Three types of enzymes are important in the primary metabolism of insecticides: hydrolases, glutathione *S*-transferases and microsomal oxidases. A study of detoxification by the earthworm is presented.

74-2424. Misato, T.; Yamaguchi, I.; Homma, Y. (Inst. Phys. Chem. Res., Saitama, Japan). **A new approach in the development of biodegradable pesticides.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 587-606.* (6 references)

Two groups of biodegradable chemicals and their utilization as fungicides were studied. Blasticidin S used in the field is subject to degradation or inactivation by the rice plant, sunlight, or microorganisms. Radioactive blasticidin S was prepared biosynthetically, and its behavior in the paddy field was studied using a model system. The activity of blasticidin S on leaves of rice plants decreased gradually. When plants were exposed to sunlight directly or on young plants, blasticidin S on leaves lost its activity more rapidly. Extraction of metabolites from the rice plant, degradation of blasticidin S on leaves, adsorption of blasticidin S by soil, and degradation by microorganisms are discussed. Utilization of N-lauroyl-L-valine as carbon and nitrogen sources by bacteria were also considered.

74-2425. Noguchi, T. (Nisso Inst. Life Sci., Oiso, Kanagawa, Japan). **Environmental evaluation of systemic fungicides.** *IN: Environmental Toxicology of Pesticides. Academic Press, New York, 1972, p. 607-632.* (5 references)

Thiophanates are highly effective in the control of many kinds of fungus diseases as well as post harvest diseases of citrus, peach, and banana. In order to establish the toxicological safety of a pesticide the following factors must be considered: acute toxicity, subacute toxicity, chronic toxicity, carcinogenicity, teratogenicity, three-generation reproduction, mutagenicity, synergistic toxicity, general pharmacology, metabolism, toxicity of the metabolites, toxicity to wildlife, toxicity to domestic animals, and residues and methods of analysis. Thiophanate-methyl had very short persistence in soil and was transformed to the metabolite methyl 2-benzimidazolecarbamate (BCM) which is also degraded at a moderate rate and gradually disappears from the soil. The major metabolite in animals, BCM, is hydroxylated at the 5-position, then eliminated as various forms of the conjugates. Even in applications of 1000 ppm, thiophanate-methyl did not exhibit serious effects on the population of bacteria, fungi, and actinomycetes.

74-2426. Wassermann, D.; Wassermann, M. (Dept. Occupational Health, Hebrew Univ.-Hadassah Med. Sch., Jerusalem, Israel). **Adrenocortical zona fasciculata in rats receiving *p,p'*-DDT.** *Environ. Physiol. Biochem. 3(6): 274-280; 1973.* (9 references)

The ultrastructure of the zona fasciculata was studied in 1-month-old male albino rats receiving 200 parts/10^6 *p,p'*-DDT in their drinking water for six months. The parenchymatous cells of the zona fasciculata of the DDT-treated animals did not differ significantly in morphology from those of the controls (treated with ethyl alcohol). These results, in light of earlier results, indicate that *p,p'*-DDT affects the adaptation of the activity of the zona fasciculata to the needs of the organism.

74-2427. David, J. R.; Becker, E. L. (Dept. Med., Harvard Med. Sch., Robert B. Brigham Hosp., Boston, MA). **Inability to block the activity of guinea pig migration inhibitory factor with di-isopropyl phosphorofluoridate.** *Eur. J. Immunol. 4(4): 287-289; 1974.* (12 references)

Migration inhibitory factor (MIF) was obtained by stimulating guinea pig lymphocytes with concanavalin A, and the culture supernatants were chromatographed on Sephadex G-100 gel columns. The MIF-rich fraction was then incubated with DFP or with other organophos-

phorus esterase inhibitors, after which the inhibitors were removed by dialysis and the media tested for their ability to inhibit the migration of normal guinea pig peritoneal exudate cells out of capillary tubes. The results indicate that guinea pig MIF activity is not destroyed by treatment with serine esterase inhibitors and cast doubt on the interpretation that MIF acts as a protease.

74-2428. Franchetti, P.; Grifantini, M.; Martelli, S. (Inst. Chim. Farm. Chim. Org., Univ. Camerino, Italy.) **Relazioni struttura-attivita nei riattivatori dell'acetilcolinesterasi inibita da composti organofosforici. [Structure-activity relationships in reactivators of acetylcholinesterase inhibited by organophosphorus compounds.]** *Farmaco (Ed. Sci.) 29(4): 309-316; 1974.* (10 references) (Italian)

The 2-and 4-hydroxyiminomethyl-1-(4-imidazolyl)methyl- and ethylpyridinium halides were synthesized and used in studies on the structure-activity relationships of these compounds toward acetylcholinesterase inhibited by organophosphates such as DFP. The number of methyl groups between the rings affects the reactivation capacity of the compounds. The position of the hydroxyimino group with respect to the imidazole ring also determines reactivating efficiency. The participation of the imidazole ring in the reactivation process shows a slight difference in reactivation behavior from that of pralidoxime.

74-2429. Civen, M.; Vancouvering, K.; Brown, C. B. (V.A. Hospital, Long Beach, CA). **Inhibition of adrenal steroidogenesis by organophosphorus insecticides.** *Fed. Proc. (Fed. Amer. Soc. Exp. Biol.) 33(5 Part 2): 1386; 1974.*

The administration of 2,2-dichlorovinyl dimethyl phosphate (dichlorvos) to rats in their drinking water at a dose of 10 mg/kg/day for 2 weeks produced a 45% depression of plasma corticosterone at the diurnal maximum. Studies carried out concurrently on ACTH and CAMP stimulated corticosterone formation by isolated rat adrenal cells showed that DDVP inhibited steroidogenesis by both of these agents (50%) at 10^{-5} *M*. On the other hand, the conversion of pregnenolone to corticosterone was not significantly inhibited at this concentration. Two other compounds, *O,O*-diethyl *O*-3,5,6 trichloro-2-pyridyl phosphorothioate and *O,O*-diethyl *O*-(2-isopropyl)-6-methyl-4-pyrimidinyl phosphorothioate produced 75% inhibition of ACTH and CAMP stimulated steroidogenesis at 10^{-4} and 10^{-3} *M* respectively in adrenal cells. The corresponding phosphate analogues of the above compounds produced a similar inhibition, but at 10^{-7} and 10^{-6} *M* respectively. In studies to determine the site of action, it has been found that DDVP does not inhibit a purified preparation of adrenal cholesterol sidechain cleavage enzyme. On the other hand, DDVP strongly inhibits adrenal cholesterol ester hydrolase (70% at 10^{-4} *M*). It also activates CAMP phosphodiesterase (65%) at 10^{-5} *M*, but completely inhibits this enzyme at 10^{-3} *M*. These results indicate that the in vivo depression of plasma corticosterone levels produced by an organophosphate compound can be correlated with its inhibition of corticosterone formation in rat adrenal cells. (Author abstract by permission)

74-2430. Gamble, W.; Olson, R. J.; Trumble, T. E. (Dept. Biochem. and Biophys., Oregon State Univ., Corvallis, OR 97331). **Action of aryloxy acids on cholesterol and fatty acid biosynthesis by rat liver homogenates.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 33(5 Part 2): 1499; 1974.*

The aryloxy acids, 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) are widely employed as herbicides. In plants they are known to elicit a number of metabolic effects. It would be, therefore, at least novel to demonstrate alterations in metabolism in animals by the compounds. We have investigated the effect of aryloxy acids on cholesterol and fatty acid biosynthesis by rat liver homogenates. 2,4-D and 2,4,5-T inhibited the incorporation of mevalonate-2-^{14}C (MVA-2-^{14}C) into cholesterol and non-saponifiable material (NSF). 2,4,5-T was a more effective inhibitor of the latter processes than 2,4-D. The conversion of isopentenyl pyrophosphate-1-^{14}C to cholesterol was inhibited by 2,4-D and 2,4,5-T. No inhibition of the conversion of MVA-1-^{14}C to CO_2 was obtained with either of the acids. Biosynthesis of cholesterol from acetate-2-^{14}C was inhibited by 2,4-D and 2,4,5-T. At low concentrations (0.5 m*M*) there was an apparent stimulation of acetate incorporation into fatty acids, whereas conversion of NSF was inhibited. Higher concentrations (4.5 m*M*) inhibited fatty acid synthesis. The data indicate that 2,4-D and 2,4,5-T elicit effects on lipid metabolism similar to those produced by the hypolipidemic drug para-chlorophenoxy-isobutyrate (Atromid-S). (Author abstract by permission)

74-2431. Manolescu, A.; Marcu, C. (Inst. Contr. Stat. Med. Cercet. Farmaceut., Bucharest, Rumania). **Modificarea efectului anticonvulsivant al diazepamului la soarece dupa tratament cu DDT sau aldrin. [Modifications in the anticonvulsant effect of diazepam in mice following treatment with DDT or aldrin.]** *Fiziol. Norm. Patol. 18(6): 559-563; 1972.* (4 references) (Rumanian)

The anticonvulsant effect of diazepam was studied in mice given DDT and aldrin p.o. four days earlier. Treatment with either of the two halogenated insecticides decreased the anticonvulsive activity of diazepam as measured by testing the pyschomotor seizures and pentetrazole convulsions. The decrease in diazepam effectiveness was interpreted as a consequence of enhancement of microsomal enzyme activity, responsible for diazepam metabolism. The organochlorine insecticides are well known microsomal enzyme inducers.

74-2432. Greer, N. I.; Janes, M. J.; Beardsley, D. W. (Dept. Entomol. Nematol., Gainesville, FL). **Toxicity of crotoxyphos insecticide to Brahman calves and Brahman and crossbred yearling steers.** *Fla. Entomol. 56(3): 243-250; 1973.* (6 references)

Four-month-old Brahman steers were tested with 3% crotoxyphos dust, 0.5% crotoxyphos spray, or 1% crotoxyphos spray, while yearling Brahman and crossbred (Hereford-Angus) steers were treated with 0.5% crotoxyphos spray or 3% crotoxyphos dust. Whole blood and red cell cholinesterase were significantly inhibited in the calves treated with 946 ml of the 1% crotoxyphos spray; two of the four calves treated exhibited severe toxicosis, and one developed skin lesions. Calves treated with 946 ml of the 0.5% spray or 3% dust showed significant cholinesterase inhibition but not clinical toxicosis. The whole blood and red cell cholinesterases of the Brahman and crossbred steers were significantly inhibited following 11 weeks of treatment with 1.9 liters of 0.5% crotoxyphos spray per week. The degree of inhibition was significantly greater in the Brahman steers than in the crossbred steers. The 3% dust offered as free-choice in a self-treatment dust bag did not produce cholinesterase inhibition; 2.7 kg of dust was used during the 11-week treatment period.

74-2433. Anonymous. **Another instalment on organo-arsenicals.** *Food Cosmet. Toxicol. 11: 895-907; 1973.* (3 references)

Two earlier studies are reviewed. A commercial formulation containing 44.9% of monosodium acid methanearsonate (MSMA) plus other ingredients (principally a dye) was given to two steers and one heifer, a 59% aqueous solution of MSMA was given to one steer and one heifer, and one steer and one heifer were used as controls. All animals were yearlings. Total arsenic content of both preparations was 21%, continued for up to 10 days. Of the MSMA treated animals, two steers died during treatment, one deteriorated on day 12 and had to be killed; one heifer died 8 days after cessation of treatment; and one recovered. Symptoms in all treated animals were severe diarrhea and loss of body weight, and the cause of death appeared to be acute kidney damage. In 25 day feeding studies with turkeys it was found that highest dietary levels causing no depression in body weight gain and feed efficiency for roxarsone (3-nitro-4-hydroxyphenylarsenic acid), nitrarsone (4-nitrophenylarsonic acid), arsanilic acid, sodium arsanilate and carbarsone (*p*-ureidobenzenearsonic acid) were 0.005, 0.02, 0.03, 0.04, and 0.32% respectively.

74-2434. Pekas, J. C.; Giles, J. L. (Metab. Radiat. Res. Lab., State Univ. Sta., Fargo, ND 58102). **Effects of dosing technique on absorption of carbaryl.** *Food Cosmet. Toxicol. 12(1): 169; 1974.*

When carbaryl mixed with gastric ingesta of donor rats was administered to fasted rats, it was absorbed much more slowly than when administered alone. A greater degree of metabolism occurred before absorption when administered with gastric ingesta. These results may explain large discrepancies between studies carried out using direct stomach intubation and results from similar studies using dietary feediing.

74-2435. Hruban, Z.; Gotoh, M.; Slesers, A. (Dept. Pathol., Univ. Chicago, Chicago, IL). **Matrical inclusions in hepatic microbodies.** *Gastroenterology 65(3): 546; 1973.*

Liver cells from male rats treated with acetylsalicylic acid, clofibrate, and dimethrin show accumulation in hepatic microbodies of matrical plates, usually arranged in stacks of about 45 A apart, 80 mμ wide and up to 1.5 μ long. The plates transform and condense into bitubular plates. As the density increases, the lucid portion disappears, resulting in a dense plate about 110 A thick. Curving of these dense plates results in the appearance of curled plates. When the curled plates reorganize, or clear spaces form within the dense plates, bitubular plates appear.

74-2436. Apostol, S. (Dept. Hyg., Iasi Med. Inst., Iasi, Rumania). **Die Wirkung des Pestizides Dipterex auf das Plankton der Oberflaechengewaesser. [Effects of dipterex on plankton of surface waters.]** *Hidrobiologia (Bucharest) 14: 303-308; 1973.* (5 references) (German)

The effects of dipterex (trichlorfon) concentrations of 1,000, 100, 10, 1, 0.1, 0.01, and 0.001 mg/liter on different plankton species in water samples taken from the Pruth River were studied in laboratory tests. Prevalence of Diatomaceae (*Stephanodiscus*) and abundance of Pennates (*Synedra*) were maintained at dipterex concentrations not higher than 1 mg/liter. Dipterex in a concentration of 0.01 mg/liter stimulated the growth of *Synedra* but this species was absent at concentrations of 10 mg/liter and over. This same concentration had stimulating effect on *Stephanodiscus* which disappeared only at 100 mg/liter concentration. *Ankistrodesmus* appeared at 10 mg/liter and grew abundantly at 100 mg/liter, and was resistant even to dipterex concentrations as high as 1,000 mg/liter. Cyanophyceae were stimulated practically at all concentrations, and Chlorophyceae were most abundant at 100 mg/liter. Prevalence of phytoplankton over zooplankton, inhibition of the Flagellata, and slightly stimulating effect on Ciliata were observed. The stimulation of many species of plankton by dipterex is most probably due to its serving as a source of phosphorus.

74-2437. Chand, N. (Dept. Pharmacol. Ther., K.G.S Medical Coll., Lucknow-3, India). **Acute toxicity of 3',4'-dichloropropionanilide in rats.** *Indian Vet. J. 50(11): 1122-1125; 1973.* (6 references)

Sixty adult healthy albino rats were divided into groups of 10 and given a single oral dose of propanil at dosage levels of 50, 100, 250, 500, and 700 mg/kg. Fifty and 100 mg/kg showed mild depression lasting 1-2 days, but no deaths. A dose of 250 mg/kg caused mild to severe depression lasting about two days with no deaths. Doses of 500 and 700 mg/kg caused toxic symptoms within five minutes and hyperactivity, CNS stimulation followed by severe depression, muscular incoordination, staggering, dyspnea, ataxia, excessive salivation, labored respiration, coma, paralysis and death within 24-48 hours. However, six rats from the 500 and three from the 700 level recovered after 48 hours. Necropsy revealed congestive hepatitis and gastroenteritis, and consolidation and patchy emphysematous lesions in the lungs.

74-2438. Thacker, E. J. (U.S.D.A., Animal Sci. Res. Div., ARS, Metabolism and Radiat., Res. Lab., Fargo, ND 58102). **Pesticide metabolism in animals.** *IN: International Symposium on Identification and Measurement of Environmental Pollutants. Campbell Printing, Ottawa, 1971, p. 92-97.* (11 references)

The metabolism and metabolic fate of agricultural chemicals in animals are under study. The rate of excretion of radiolabeled atrazine, propazine, simazine, prometone, and 2-methoxy-4-ethylamino-6-*sec*-butylamino-*s*-triazine was rapid, with the majority of the radioactivity (ring-labeled) appearing in the urine in 48 hr. The radioactivity of the urine was separated into at least 19 fractions by ion exchange chromatography. The metabolic transformations of 2-methoxy-4-ethylamino-6-*sec*-butylamino-*s*-triazine, which occurred in the cow, involved hydrolysis, dealkylation, and oxidation reactions. Metabolic transformations were identified by mass spectrometry. Carbaryl, a carbamate insecticide, was rapidly metabolized and excreted by the chicken, with minor residues of radioactivity found in the tissues 48 hr after dosing. Products of carbaryl metabolism in the chicken were isolated and identified. Studies such as these can not only pinpoint hazards of a specific pesticide in agricultural use, but can also assess potential contamination of the environment from residues of pesticides present in animal wastes.

74-2439. Jezequel, A. (Div. of Gastroenterol., General Hosp., Ancona, Italy). **Ultrastructural basis of drug metabolism.** *Isr. J. Med. Sci. 10(4): 380-385; 1974.* (22 references)

Rat liver rough (RER) and smooth (SER) endoplasmic reticulum increased in the first two days of phenobarbital treatment. Thereafter, the RER values returned to normal while the SER continued to increase. Mitochondria and peroxisomes increased in number, and nuclei increased in volume and number. DDT and various other insecticides also acted according to this model. During carbon tetrachloride and dieldrin intoxication, increase in drug-metabolizing enzymes did not accompany the increase in SER, suggesting dissociation of the two phenomena. Myelin figures and fingerprints or cytolysomes have been observed after DDT administration.

74-2440. Hilton, H. W.; Nomura, N. S.; Yauger, W. L., Jr.; Kameda, S. S. (Exp. Sta., Hawaiian Sugar Planters' Ass., Honolulu, HI 95822). **Absorption, translocation, and metabolism of metribuzin (BAY-94337) in sugarcane.** *J. Agr. Food Chem. 22(4): 578-582; 1974.*

Radioactivity from root-absorbed metribuzin, labeled with ^{14}C at position 5 in the ring, was deposited mainly in the leaves as unknown metabolites. Less than 10% of the ^{14}C could be accounted for and measured by gas chromatography as the parent herbicide and three known metabolites; acid hydrolysis increased recovery to about 10%. At 12 weeks, 84% of the radioactivity initially added to the nutrient solution was recovered—75% in the plant tissue, including abscised leaves, and 9% in the nutrient medium. Foliar treatment resulted in a distal movement within the leaves of 5–20% of the applied ^{14}C; another 10–20% remained at the treated site and 1–2% appeared proximally to the treatment area. Foliar residues averaged 25% of the amount applied, relatively independent of the length of time after surface treatment. (Author abstract reprinted by permission of the American Chemical Society)

74-2441. Barnett, J. R.; Dorough, H. W.* (Dept. Entomol., Univ. Kentucky, Lexington, KY 40506). **Metabolism of chlordane in rats.** *J. Agr. Food Chem. 22(4): 612-619; 1974.* (7 references)

The fate of HCS-3260-^{14}C (3:1 *cis*-chlordane and *trans*-chlordane) and the individual isomers was studied in rats. Single oral doses of the compounds were almost completely (> 90%) eliminated after 7 days. Females excreted more of the dose, 5-6%, in the urine than did the males, 2-3%. *cis*-Chlordane was eliminated more rapidly, 70% after 24 hr, than the trans isomer, 60% after 24 hr. Approximately 15% of the radiocarbon in the 0-24-hr feces was as the administered compound, but none was detected in the urine. The metabolites in the excreta were formed predominantly by dechlorination and various degrees of hydroxylation of the cyclopentane ring. Levels of residues in the fat of rats after being fed 1, 5, and 25 ppm of HCS-3260-^{14}C in the diet for 56 days were approximately three times the parts per million level in the diet. In liver, kidney, brain, and muscle, the levels were 1/8, 1/10, 1/25, and 1/50 that of the concentration in the feed. Oxychlordane was the major ^{14}C residue in the tissues, ranging from 50% of the radiocarbon in the kidney to about 90% in the fat. Feeding *trans*-chlordane gave higher residue levels in the tissues than *cis*-chlordane, the increase being primarily in higher oxychlordane concentration. Oxychlordane was the most persistent residue in the tissues after

the chlordane was removed from the diet. (Author abstract reprinted by permission of the American Chemical Society)

74-2442. Pree, D. J.; Saunders, J. L. (Coll. Agr., Western Wash. Res. Ext. Cent., Washington State Univ., Puyallup, WA 98371). **Metabolism of carbofuran in mugho pine.** *J. Agr. Food Chem. 22(4): 620-625; 1974.* (30 references)

Radiolabeled carbofuran applied to mugho pine roots was translocated primarily to needles. Metabolism was slower than reported in other plants and animals. At least two and possibly three metabolic pathways were operative. 3-Hydroxycarbofuran and an unknown metabolite (unknown II), tentatively identified as *N*-hydroxymethylcarbofuran, were detected from metabolism of [*carbonyl*-^{14}C] carbofuran. Carbofuran phenol, 3-ketocarbofuran phenol, 3-hydroxycarbofuran, and two unknown metabolites were detected using [*ring*-^{14}C]-carbofuran. Metabolites were mainly in the nonconjugated form in early samples but later most were in the aqueous phase as glycosides. Acid hydrolysis freed all metabolites and treatment with β-glucosidase or β-glucuronidase freed all except unknown II. Metabolism of unknown II to carbofuran phenol was indicated by corresponding increases in phenol as unknown II declined. Increases in 3-ketocarbofuran phenol were accompanied by decreased levels of 3-hydroxycarbofuran. Direct hydrolysis to carbofuran phenol or rapid hydrolysis of unknown II to carbofuran phenol was indicated. (Author abstract reprinted by permission of the American Chemical Society)

74-2443. Gilman, A. P.; Vardanis, A.* (Agr. Can. Res. Inst., London, Ontario N6A 3KO, Canada). **Carbofuran. Comparative toxicity and metabolism in the worms *Lumbricus terrestris* L. and *Eisenia foetida* S.** *J. Agr. Food Chem. 22(4): 625-628; 1974.* (12 references)

Eisenia foetida, a manure worm, showed characteristic symptoms of carbofuran poisoning (coiling and random muscle contractions). There appeared to be, however, a wide difference between this species and *Lumbricus terrestris*, the common dew worm, in susceptibility to this carbamate insecticide. Compared to the toxicity toward the dew worm this compound was one-sixth as toxic to *Eisenia* when injected and approximately half as toxic when applied to the soil. The insecticide appeared to repel *Eisenia* but not *Lumbricus*. Both worms took up carbofuran in quantities proportional to their size; however, *Eisenia* excreted 95% of this material in 48 hr compared to only 10% excreted by *Lumbricus*. Approximately half of the excreted material in the case of *Eisenia* was unchanged insecticide. Of the insecticide broken down by the worms in a 48-hr period, *Eisenia* retained only 5% as metabolites whereas *Lumbricus* retained 87%. This comparative study emphasized the importance of selecting truly representative species for the evaluation of new insecticides. (Author abstract reprinted by permission of the American Chemical Society).

74-2444. Paulson, G. D.; Jacobsen, A. M. (Agr. Res. Serv., Metab. and Radiation Res. Lab., Fargo, ND 58102). **Isolation and identification of propham (isopropyl carbanilate) metabolites from animal tissues and milk.** *J. Agr. Food Chem. 22(4): 629-631; 1974.* (11 references)

Chickens and a goat were given a single dose (100 mg/kg of body weight) of isopropyl carbanilate-*phenyl-U*-^{14}*C*. Radiolabeled metabolites in goat milk, goat tissue, and chicken tissue were isolated by solvent extraction and column chromatography and then identified by comparative spectrometry. Goat milk and goat tissue contained the sulfate ester of isopropyl 4-hydroxycarbanilate (A) and two minor unidentified ^{14}C-labeled fractions. Chicken tissue contained A, the glucuronic acid conjugate of isopropyl 4-hydroxycarbanilate, isopropyl carbanilate, and two minor unidentified ^{14}C-labeled fractions. (Author abstract reprinted by permission of the American Chemical Society)

74-2445. Dorough, H. W.; McManus, J. P.; Kumar, S. S.; Cardona, R. A. (Dept. Entomol., Univ. Kentucky, Lexington, KY 40506). **Chemical and metabolic characteristics of 1-naphthyl β-D-glucoside.** *J. Agr. Food Chem. 22(4): 642-645; 1974.* (6 references)

1-Naphthyl β-D-glucoside was stable under a variety of conditions encountered in metabolism studies. No degradation occurred when stored in methanol or in Tris-HCl buffer (pH 7.0) for 1 week at -20, 0, and 25°. The glucuronide of 1-naphthol was degraded by about 30% after 1 week in the buffer at 25°, but was equal in stability to the glucoside in all other experiments. When 1-naphthyl-^{14}*C* glucoside was given orally to rats, 67% of the radiocarbon was eliminated in urine after 24 hr. Of this, 28% was the administered compound, 35% 1-naphthyl glucuronide, 15% 1-naphthyl sulfate, and 14% was 1-naphthol. Cleavage of the glucoside linkage was possibly the sole initial step in the metabolism of the compound. However, 1% of a 1-naphthyl glucoside-*glucose*-^{14}*C* dose was tentatively identified as 1-naphthyl glucuronide, indicating that oxidation of the sugar moiety of intact 1-naphthyl glucoside may have taken place. 1-Naphthol-^{14}*C* given as a single oral dose was eliminated from rats more rapidly, 90% of the dose in the 0–24 hr urine, than was its glucoside conjugate. 1-Naphthyl glucuronide constituted 81% of the radiocarbon while 17% was 1-naphthyl sulfate and only 1.6% was free 1-naphthol. (Author abstract reprinted by permission of the American Chemical Society)

74-2446. Ivie, G. W.; Gibson, J. R.; Bryant, H. E.; Begin, J. J.; Barnett, J. R.; Dorough, H. W.* (Dept. Entomol., Univ. Kentucky, Lexington, KY 40506).

Accumulation, distribution, and excretion of mirex-^{14}C in animals exposed for long periods to the insecticide in the diet. *J. Agr. Food Chem. 22(4): 646-653; 1974.* (11 references)

Mirex-^{14}C administered in the diets of laboratory rats, Japanese quail, and mosquito fish was retained at high levels in the body, and was not metabolized to any detectable extent. Maximum residue accumulation occurred in adipose tissue, and after 16 months of continuous treatment, mirex levels in the fat of rats and male birds were about 120- and 185-fold greater than dietary intake levels, respectively. Ratios of the levels of mirex in the tissues of rats and quail to those in the diet were approximately the same at feeding levels of 0.3, 3.0, and 30.0 ppm. No plateau in tissues was observed in either rats, male quail, or mosquito fish. Mirex residues in the tissues of female quail were much lower than in males, because the female birds eliminated very large mirex quantities through the egg yolk. Examination of several reproductive parameters, including egg hatch, chick growth, and survival, showed that high levels of mirex in the egg yolk, up to 200 ppm, caused no adverse effects. Dissipation rates of mirex from the body after removing the insecticide from the diet varied with the animal species. The half-life of the residues in the whole body of the fish was 130 days, while in the fat of female and male quail it was about 20 and 30 days, respectively. In the fat of female rats, the residues had declined by only 40% after being returned to a normal ration for 10 months. (Author abstract reprinted by permission of the American Chemical Society)

74-2447. Khalifa, S.; Mon, T. R.; Engel, J. L.; Casida, J. E.* (Div. Entomol. Parasitol., Univ. California, Berkeley, CA 94720). **Isolation of 2,2,5-endo,6--exo,8,9,10-heptachlorobornane and an octachloro toxicant from technical toxaphene.** *J. Agr. Food Chem. 22(4): 653-657; 1974.* (11 references)

Technical toxaphene was subjected to the following sequence of chromatographic steps to isolate those components which are of the highest acute toxicity to mice treated intraperitoneally: liquid–liquid partition column, adsorption column, and preparative gas–liquid chromatography. Two crystalline toxicants were isolated, one a $C_{10}H_{10}Cl_8$ component 14-fold more toxic to mice than toxaphene and the other a $C_{10}H_{11}Cl_7$ component with a sixfold greater toxicity than toxaphene. These two compounds are four- and twofold more toxic, respectively, than toxaphene to houseflies treated topically. The $C_{10}H_{11}Cl_7$ component is identified as 2,2,5-*endo*,6-*exo*,8,9,10-heptachlorobornane. The $C_{10}H_{10}Cl_8$ and $C_{10}H_{11}Cl_7$ toxicants, which make up about 6 and 3%, respectively, of technical toxaphene, appear to contribute significantly to its mammalian toxicity. These chromatographic procedures should be appropriate to isolate any individual component of toxaphene provided it is stable under the chromatographic conditions employed and a suitable monitoring technique is available. (Author abstract reprinted by permission of the American Chemical Society).

74-2448. Lichtenstein, E. P.; Liang, T. T.; Schulz, K. R.; Schnoes, H. K.; Carter, G. T. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **Insecticidal and synergistic components isolated from dill plants.** *J. Agr. Food Chem. 22(4): 658-664; 1974.* (18 references)

Dill plants (*Anethum graveolus* L.), whose seeds have been used for centuries for flavoring of various human foods, were found to contain insecticidal components which also were synergistic for carbamate and organophosphorus insecticides with some insect species. Four major compounds were isolated and identified: *d*-carvone was present in the aerial parts of dill, including seeds ("dill greens") at 3625 ppm, myristicin was found in both dill "greens" (24 ppm) and roots (41 ppm), while apiol and its isomer, dill-apiol, were present only in roots at 271 and 227 ppm, respectively. The LD50 of *d*-carvone administered intravenously to mice was 1500 mg/kg body weight, and that of myristicin was 200 mg/kg. Apiol had a LD50 of 500 mg/kg (intravenous in dogs). Food plants may contain substances which by themselves exhibit negligible biological activities, yet which could interact with residues of synthetic insecticides or other synthetic chemicals in the animal body. (Author abstract, modified; reprinted by permission of the American Chemical Society)

74-2449. Rumsey, T. S.; Bond, J.* (Ruminant Nutr. Lab., Nutr. Inst., Agr. Res. Serv., U. S. Dept. Agr., Beltsville, MD 20705). **Effect of urea, diethylstilbestrol, and type of diet on the distribution of aldrin and dieldrin residues in finished beef heifers.** *J. Agr. Food Chem. 22(4): 664-667; 1974.* (19 references)

The effect of nutritional regimen on aldrin and dieldrin residue concentrations and distribution was studied in 16 Angus heifers. All heifers were on experiment from 14 days of age to slaughter (18 months) and were fed 1.0 mg of aldrin/kg of body weight daily from 42 days. The heifers were assigned to a factorial arrangement of nutritional regimens to compare urea vs. soybean meal, a concentrate vs. a forage diet, and diethylstilbestrol (DES) implants vs. no DES. The average concentration of aldrin was 7 times greater and that of dieldrin 14 times greater in fat tissue than in organ and muscle tissues. The average tissue concentration of dieldrin was more than 100 times greater than that of aldrin. Among the fat tissues, the concentration of residues was highest in heart and kidney fats, intermediate in external rib and caul fats, and lowest in internal rib, brisket, perianal, and ruffle fats. Nutritional regimens did not affect the distribution of residues among fat tissues but did influence the average residue concentration in beef heifers. (Author abstract reprinted by permission of the American Chemical Society)

74-2450. Guthrie, F. E.; Shah, P. V.; Moreland, D. E. (Dept. Entomol., North Carolina State Univ., Raleigh, NC 27607). **Effects of pesticides on active transport of glucose through the isolated intestine of the mouse.** *J. Agr. Food Chem. 22(4): 713-715; 1974.* (26 references)

The effects of a number of pesticides were examined on active transport of glucose through the isolated intestine of the mouse. Inhibition of active transport was apparent for all of the fungicides tested. A majority of the herbicides were also inhibitory, and slightly less than one-half of the insecticides gave this type of action. Although an inhibitory effect was usually supported by previously reported inhibition of mitochondrial activity, a number of compounds which are known to uncouple oxidative phosphorylation or interrupt electron transport did not affect active transport of glucose in these experiments. (Author abstract reprinted by permission of the American Chemical Society)

74-2451. Feng, H.; Rogers, A. W.; Salpeter, M. M. (Sch. Appl. Eng. Phys., Sect. Neurobiol. Behav., Cornell Univ., Ithaca, NY). **Recovery of esterases at muscle endplates inactivated by DFP.** *J. Cell Biol. 59(2): 98; 1973.*

Histochemical, morphological, and EM autoradiographic investigations were performed on sternomastoid removed at intervals of 0 to 21 days from mice after application of diisopropylfluorophosphate (DFP) to one exposed sternomastoid muscle. No stained endplates were evident in muscles removed immediately after the DFP. Staining increased in intensity with time postoperatively and by 21 days was comparable to that in controls. Early postoperative destruction of the muscle was apparent by both light and electron microscopy, with necrosis being localized at the endplate region. Morphological recovery paralleled that of the enzyme. EM autoradiographic studies of muscle incubated in H^3-DFP to label the post-inhibition, newly emerging esterase sites revealed no sites above muscle background immediately after the inhibition. At three days the new esterase sites were primarily located in the Schwann cell and teloglial cap connective tissue. The reappearance of DFP reactive sites was slower at the post junctional region than in the Schwann cell. By 14 days the local concentration was more than 50% of the control value. Differentiation of esterases with pyridine-2-aldoxime showed the ratio to be within the normal range during recovery.

74-2452. Singhal, R. L.; Kacew, S. (Dept. Pharmacol., Univ. Ottawa, Ottawa, K1N 6N5 Canada.) **Evidence for the role of cyclic AMP in the mechanism of action of organochlorine pesticides.** *J. Cell Biol. 59(2 Part 2): 321; 1973.*

Incubation of renal and hepatic slices with *p,p'*-DDT, α-chlordane, heptachlor, or endrin (10^{-7}-10^{-5} *M*) enhanced the in vitro capacity of both tissues to biotransform radioactive adenosine into cyclic AMP-^{3}H. Simultaneous treatment with an inhibitor of phosphodiesterase such as theophylline and a submaximal dose of *p,p'*-DDT further augmented the pesticide-induced elevation in blood glucose and urea, and hepatic and renal gluconeogenic enzymes. In both kidney and liver of insecticide-treated rats the activity of basal- and fluoride-stimulated forms of adenyl cyclase and the endogenous levels of cyclic AMP were also increased. However, none of the hydrocarbon pesticides tested altered the activity of phosphodiesterase in either tissue. In vitro activity of adenyl cyclase in renal cortex homogenates was increased by the addition of *p,p'*-DDT. Administration of exogenous cyclic AMP mimicked the action of *p,p'*-DDT, α-chlordane, heptachlor, and endrin on gluconeogenesis and glycogenolysis as well as the hyperglycemic and hyperuremic responses.

74-2453. Brown, D. L; Bouck, G. B. (Dept. Biol., Univ. Ottawa, Ottawa, Canada). **Microtubule biogenesis and cell shape in *Ochromonas*. III. Effects of the herbicidal mitotic inhibitor isopropyl *N*-phenylcarbamate on shape and flagellum regeneration.** *J. Cell Biol. 61(2): 514-536; 1974.* (35 references)

The effects of the mitotic inhibitors propham (IPC) and chloropropham (CIPC) on the microtubules and microtubule nucleating sites of the unicell organism, *Ochromonas*, were studied. Although IPC and CIPC had little or no effect on intact microtubules, the assembly of three separate sets of microtubules was differentially affected by the two pesticides. The assembly of flagellar microtubules after mechanical deflagellation was partially inhibited, the reassembly of rhizoplast microtubules after pressure depolymerization was totally inhibited, and the reassembly of the beak set of microtubules after pressure depolarization was unaffected. These effects were fully reversible. The kinetics of inhibition and reversal were similar for both flagellar and cell shape regeneration. Neither IPC nor CIPC significantly affected protein synthesis in short-term experiments, although the inhibition of protein synthesis by cycloheximide had little effect on microtubule regeneration following the removal of IPC or CIPC. Although the exact target for the action of IPC and CIPC is uncertain, the microtubule protein pool or the microtubule nucleating sites are specifically and reversibly affected. The mode of action of the mitotic inhibitor colchicine is similar in some respects to that of IPC and CIPC with regard to the assembly and disassembly of microtubles in *Ochromonas*.

74-2454. Watari, N.; Torizawa, K. (Fir. Dept. Anat., Nagoya City Univ. Med. Sch., Nagoya, Japan). **Ultrastructural alterations of the mouse pancreas after the prolonged administration of BHC.** *J. Electronmicrosc. 21(4): 334; 1972.*

Electron microscopic observation of pancreatic tissue from mice administered γ-BHC (lindane) in doses

of one ppm in drinking water for periods of one to twelve months revealed that the nuclei of the acinar and islet cells were sometimes pyknotic and changed into peculiar shapes, including elongated, thread-like, curved, or kidney-shaped. A majority of the zymogen granules were vacuolated; rough-surfaced endoplasmic reticulum was flattened; and Golgi apparatus was atrophied, suggesting cell hypofunction. Primary lysosomes and autophagic vacuoles were increased in number. Some islet cells showed hydropic degeneration. A large number of mitochondria were degenerated, and some were changed into gigantic ones.

74-2455. Breslow, N. E.; Day, N. E.; Tomatis, L.; Turusov, V. S. (International Agency for Research on Cancer, 69008 Lyon, France). **Associations between tumor types in a large-scale carcinogenesis study of CF-1 mice.** *J. Nat. Cancer Inst. 52(1): 233-239; 1974.* (11 references)

CF-1 mice 6-7 weeks old were divided into 6 groups, each composed of 60 males and 60 females. Four groups received DDT in the diet at concentrations of 2, 10, 50 and 250 ppm; the fifth group was given a control diet, and the sixth was given 0.01% urethane in the drinking water ad libitum. After 120 offspring were born in each group, the offspring were separated to form a subsequent generation, and the parental (P) and F-1–F-5 generations studied. Mortality of both sexes was highest in the DDT 250 and urethane groups and was higher in the DDT 2, 10 and 50 ppm male groups than in the controls after 90 weeks. After adjusting for associations between tumor types arising from age-specific tumor prevalence curves and grouping of animals by treatment, statistically significant associations still remained. Lymphomas were negatively associated with hepatomas, lung adenomas, mammary and ovarian tumors, and positively associated with bone tumors. Except for the relationship between lymphomas and hepatomas, negative associations may be an artifact due to the relative rapidity with which lymphomas kill their bearers.

74-2456. Doherty, J. D.; Matsumura, F. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **DDT effect on ^{32}P incorporation from γ-labelled ATP into proteins from lobster nerve.** *J. Neurochem. 22(5): 765-772; 1974.* (17 references)

DDT affected the amount of ^{32}P from (γ-^{32}P)ATP incorporated into proteins derived from lobster peripheral nerves. When a high ATP concentration (2.5×10^{-5}) was used, DDT (10^{-5} *M*) inhibited the incorporation and reversed the increased incorporation caused by ouabain. At low ATP concentrations (8.6×10^{-8} *M*) DDT inhibited the incorporation when the buffer contained Mg^{2+} and Na^{+} or K^{+} alone; DDT produced no consistent increase when the buffer contained Mg^{2+} and both Na^{+} and K^{+}. The ability of DDT to produce increases in the incorporation of ^{32}P into lobster nerve proteins paralleled many of the properties shown when this pesticide is used to poison crustacean nerves. For example, the effect was negatively temperature dependent, Ca^{2+} lowered the incorporation in the presence of DDT, and DDT consistently caused greater amounts of ^{32}P to be incorporated than did its less potent analog DDE. The proteins which were affected by DDT were microsomal and could be separated from the supernatant by recentrifugation at 149,000 g. This system may be the actual target through which DDT causes its characteristic interferences with the ionic conductance changes associated with the action potential.

74-2457. Charles, R. T.; Turusov, V. S. (Int. Agency Res. Cancer, Lyons, France). **Bone tumours in CF-1 mice.** *Lab. Anim. 8(2): 137-144; 1974.* (8 references)

Osteomas arising in minimal inbred CF-1 mice were observed over a period of six generations. The animals were maintained on basal diets or basal diets containing DDT or urethane. The overall incidence of tumors was higher among females than males, but did not differ among the control, DDT-treated, and urethane-treated groups. The site distribution of osteomas in the DDT-treated mice differed somewhat from that in the untreated groups, the skull being involved less frequently and other sites being involved more frequently. These differences did not appear to be significant. A total of 15 osteosarcomas occurred in this series, nine of them occurring among the DDT-treated animals.

74-2458. Pocock, D. M. E.; Vost, A. (McGill Univ. Med. Clin., Montreal Gen. Hosp., Montreal, Quebec, Canada). **DDT absorption and chylomicron transport in rat.** *Lipids 9(6): 374-381; 1974.* (27 references)

Male Wistar rats were given 100 n*M* of DDT-^{14}C in oil via gastric tube. Recovery of this compound in the thoracic duct lymph was 60% in 12 hours; 97% of the radioactivity was found in lipoproteins of $d < 1.006$, i.e., chylomicrons, the DDT being located in the triglyceride core. Rats were subsequently injected with chylomicrons which had been doubly labeled with triglyceride-^{3}H and DDT-^{14}C. The decay of the DDT in the serum was rapid ($T\frac{1}{2}$ = 2 minutes) and was independent of the triglyceride decay. Fourteen minutes after chylomicron injection, 30% of the administered DDT was found in the liver, with only 1% being found in the adipose tissue. In hepatectomized (eviscerated) rats, the decay of serum DDT-^{14}C ($T\frac{1}{2}$ = 10 minutes) was also independent of and more rapid than triglyceride-^{3}H decay. In sucrose density gradients, the chylomicron DDT-^{14}C transferred to higher density serum proteins in vitro and in vivo and to bovine albumin in vitro. Thus, DDT was transported to the large intestine in the triglyceride phase of the chylomicrons, the disappearance of chylomicron-DDT from the systemic circulation was

rapid and partially independent of the presence of the liver and triglyceride hydrolysis, and some DDT was transported from the serum chylomicrons to albumin or other plasma proteins prior to tissue uptake.

74-2459. Ernst, W.; Goerke, H. (Inst. fuer Meeresforschung, Bremerhaven, Germany). **Anreicherung, Verteilung, Umwandlung und Ausscheidung von DDT-14C bei *Solea solea* (Pisces: Soleidae). [Accumulation, distribution, transformation and elimination of DDT-^{14}C in *Solea solea* (Pisces: Soleidae).]** *Mar. Biol. 24(4): 287-304; 1974.* (52 references) (German)

The accumulation, distribution, metabolism, and elimination of ^{14}C-labeled DDT were studied in *Solea solea*. Specimens of age group I were kept in water of 10° C and 2% salinity and were given oral doses (introduced in *Lanice conchilega*) of 0.85 μg DDT up to five times weekly. A total application of 1.7, 17, or 35 μg DDT, corresponding to 3, 28, or 57 experimental days, resulted in 72, 60 or 43% DDT accumulation. *S. solea* fed 17 μg unlabeled DDT for 4 weeks and a final feeding of 1.7 μg for 2 days accumulated 74%, the same percentage as after feeding with 1.7 μg and no prior feeding. Decreasing accumulation with increasing doses, i.e., longer application periods, is due to elimination during the application period. During two months in pesticide-free water, *S. solea* eliminated 62% of the DDT which it had accumulated after feeding with 1.7, μg for four weeks. The gastrointestinal tract is assumed to be the major route of DDT elimination. Independent of dosage, the DDT levels were highest in the brain, liver, and gastrointestinal tract and lowest in the skeletal muscles. The distribution pattern remained unchanged even during elimination. While over 80% of the DDT remained unchanged in all organs, DDE, DDD, and a polar metabolite were found. The percentage of metabolism was higher in the liver and gastrointestinal tract than it was in the skeletal muscles. Prolonged exposure to DDT in the diet induced DDT transformation in the gastrointestinal contents and most probably in the bacterial flora of the gut.

74-2460. Yanev, E.; Yakimov, Ya.; Dimitrov, T. (Dept. Pathological Physiol., Central Res. Lab. Radiobiol. Control Harmful Rodents). **Experimental studies on cerebral electrogenesis in acute tinox 50 poisoning.** *Nauch. Tr. Vissh. Med. Inst. Sofia 51(4): 55-62; 1972.* (12 references)

Five mongrel dogs were given lethal doses of the organophosphate pesticide tinox 50 (5-10 mg/kg) s.c. and their electroencephalographic patterns observed. Acute tinox poisoning induced EEG changes preceding and accompanying the clinical manifestations. The initial EEG changes consisted of phonic rhythm disturbances with a rise in amplitude and some acceleration. The next phase was characterized by the acute appearance of high-amplitude delta and theta waves. The later phases of poisoning were accompanied by the appearance of slow high-amplitude waves, which occurred singly and in groups. EEG studies may be used in conjunction with other parameters for the early diagnosis, prognosis, and prophylaxis of tinox poisoning.

74-2461. McQueen, E. G. (Dept. Pharmacol., Med. Sch., Univ. Otago, Dunedin, New Zealand). **Drug displacement from protein binding and redistributional interactions.** *Nephron 10(6): 367; 1974.*

Studies of binding of anionic drugs to albumin performed on a series of chlorophenoxy acids suggested that the binding of these drugs involves two types of bond, one hydrophobic and one ionic. The redistributional basis of the precipitate fall in plasma level of displaced drug, sulphadoxine, was demonstrated in displacement studies in sheep using two similarly bound drugs, sulphadoxine and phenylbutazone. Interaction of drugs and organochlorine pesticides also occurs, phenytoin being particularly effective in lowering blood levels of pesticide residues. Efficacy of phenytoin as a displacer varies inversely with lipid solubility of the pesticide. The carriage of different pesticides involves different protein fractions.

74-2462. Overstreet, D. H.; Russell, R. W.; Vasquez, B. J.; Dalglish, F. W. (Sch. Biol. Sci., Flinders Univ., South Australia, Australia). **Involvement of muscarinic and nicotinic receptors in behavioral tolerance to DFP.** *Pharmacol. Biochem. Behav. 2(1): 45-54; 1974.* (47 references)

The effects of various cholinergic agents (physostigmine, neostigmine, carbachol, pilocarpine, methyl atropine, atropine, nicotine, mecamylamine, and scopolamine) on the free operant responding and single alternation behavior of male Sprague-Dawley rats were determined following two regimens of chronic DFP treatment. The DFP treatments lowered the brain cholinesterase levels to 45% and 30% of normal, respectively. Reduction of the brain cholinesterase levels to 45% did not produce observable effects on behavior, while reduction to 30% decreased the number of reinforced responses and increased the number of nonreinforced responses. Tolerance for the former measure developed within 10 days, whereas tolerance for the latter was not observed. Subsequent challenges were carried out using anticholinesterase agents and muscarinic and nicotinic agonists and antagonists. The results indicated that the sensitivity of both muscarinic and nicotinic receptors to acetylcholine may be reduced during chronic treatment with DFP; however, muscarinic receptors may be more labile than nicotinic receptors. This reduction in sensitivity may be one mechanism underlying the development of behavioral tolerance to DFP.

74-2463. McPhillips, J. J.; Westfall, D. P.; Foley, D. J. (Dept. Pharmacol., W. Va. Univ. Med. Cent., Morgantown, WV 26506). **Inhibition of cholinesterase activity after postganglionic denervation of the rat vas deferens.** *Pharmacologist 15(2): 172; 1973.*

The increase in sensitivity to acetylcholine after denervation was shown to have a prejunctional component—inhibition of cholinesterase activity—but the contribution of this component to the total increase in sensitivity to acetylcholine was small. At day 7 after postganglionic denervation a 50-fold increase in sensitivity of the smooth muscle to acetylcholine was found, as well as a marked inhibition (55-60%) in the hydrolysis of radiolabeled acetylcholine and methacholine by homogenates of vasa deferentia. Twenty-four hours after the administration of an organophosphorus cholinesterase inhibitor, 5 mg/kg disulfoton, a 2-fold increase in the sensitivity of the smooth muscle to acetylcholine occurred, with an inhibition of cholinesterase activity equivalent to that produced by denervation. Smooth muscle sensitivity to carbachol was increased by denervation (65-fold), but not by disulfoton.

74-2464. La Rocca, P. T.; Carlson, G. P.; Fuller, G. C. (Dept. Pharmacol. Toxicol., College Pharm., Univ. Rhode Island, Kingston, RI 02881). **The relationship between sulfhydryl reactivity and toxicity of vinyl sulfone molluscicidal agents.** *Pharmacologist 15(2): 188; 1973.*

In vivo and in vitro studies of vinyl sulfone (VS) indicated that the toxicity of VS is not related to the inhibition of endogenous respiration (ER) in either snails or rats. High concentrations of VS were required to inhibit the activity of malic dehydrogenase (MDH). An ip LD50 of 3 mg/kg VS was found for male and female rats. Blood urea nitrogen was increased and urinary output decreased by a sublethal dose of VS. Rat SGOT, SGPT, and hematocrit levels were unaffected. Impairment of normal renal function is suggested as the cause of the toxicity of sublethal doses of VS.

74-2465. Bus, J. S.; Gibson, J. E. (Dept. for Pharmacol., Michigan State Univ., East Lansing, MI 48823). **Development of acetylcholinesterase in mouse brain and its response to Bidrin.** *Pharmacologist 15(2): 198; 1973.*

Brain acetylcholinesterase (AChE) activity was measured in Swiss Webster mice during normal gestation and after administration of Bidrin, an organophosphate insecticide. AChE activity was measured radiometrically using ^{14}C-labeled acetyl-methylcholine (Mech) as substrate. During normal gestation activity in the fetal brain increased from 0.329 nmole Mech hydrolyzed/mg protein/min (nmh/mp/m) on day 15 to 1.800 nmh/mp/m on day 19, remaining approximately constant until day 7 postnatally and then gradually increasing in adults to 7.291 nmh/mp/m. Five mg/kg Bidrin ip on day 19 of gestation reduced fetal AChE activity 7-fold from controls. Five mg/kg Bidrin ip on days 8-16 of gestation did not change AChE activity from control when measured on day 19 of gestation. Acute administration of Bidrin on day 19 of gestation depressed AChE activity transiently while AChE was fully recovered following chronic Bidrin treatment during gestation.

74-2466. Wheeler, L.; Strother, A. (Loma Linda Univ., Loma Linda, CA 92354). **In vitro metabolism of ^{14}C-pesticidal carbamates (zectran, mesurol, and carbaryl) by rat placenta, fetal brain and fetal liver.** *Pharmacologist 15(2): 199; 1973.*

Two pathways of pesticide metabolism were identified by autoradiography and thin-layer chromatography. Zectran (mexacarbate) (Z) was *N*-dealkylated to 4-methylamino-3,5-xylyl *N*-methylcarbamate (MA). Placenta (P) and fetal liver (FL) did not metabolize Z. Sulfoxidation of mesurol (methiocarb) (M) was found in FL and to a lesser extent in P. Mesurol added in vitro was converted to 4-methylsulfinyl-3,5-xylyl *N*-methylcarbamate (MS) by FL and P. Zectran and carbaryl were not metabolized by FL. Apparently more potent metabolites are produced because MA and MS are more potent acetylcholinesterase inhibitors than Z or M.

74-2467. McLachlan, J. A.; Dixon, R. L. (Nat. Inst. Environ. Health Sci., Nat. Inst. of Health, Research Triangle Park, NC 27709). **Effect of gestational exposure to DDT or diethylstilbestrol on the reproductive capacity of offspring.** *Pharmacologist 15(2): 199; 1973.*

Effects of prenatal exposure to DDT and diethylstilbestrol (DES) on postnatal reproductive capacity were examined in mice. DDT has weak estrogenic activity and induces sterility in neonatally treated rats; DES, a synthetic estrogen, has been linked with vaginal carcinomas in prenatally treated offspring. Mice were given DDT at 1 mg/kg or DES at 10 or 0.1 μg/kg s.c. on days 10-16 of gestation. No significant differences were observed between prenatally exposed animals and controls at puberty with respect to response to exogenous gonadotropins, quantitative ovarian morphology, or estrous cycles. When 30-60 weeks of repetitive forced breeding were initiated at puberty, the female offspring of DDT-treated mice produced 30% fewer young than the corresponding controls. Animals exposed to high and low DES dosages delivered respectively 60% and 40% fewer yound than controls. The action mechanism is unclear.

74-2468. Renden, J. A.; Abbott, U. K. (Dept. Avian Sci., Univ. California, Davis, CA 95616). **The response of avian skin to an oil-based pesticide and its oil carriers.** *Poultry Sci. 52(5): 2077; 1973.*

Dermatitis has been produced in birds from three lines of chickens, one and ten weeks old, by topical

treatment with an oil-based pesticide (carbophenothion) and oil carriers (mineral oil and corn oil). After four consecutive daily treatments of pesticide and/or oil there was scaling and flaking of the skin with a few birds showing small open sores. Histologically, treated sections showed a marked increase in epidermal thickness and hyperplasia and hypertrophy of epidermal layers. Cells of the basal layer became more columnar, cell proliferation was increased, the distinct epidermal-dermal border was lost, and numerous heterophiles were observed. The dermatitis was subacute in normal and scaleless birds receiving both oil and the pesticide with oil treatments. Dehydrated chicks have a high rate of epidermal mitosis, and excessive keratinization of epidermal structures; their skin proved especially susceptible to oil damage. They developed a very quick and severe dermatitis characterized as acanthosis. Significant effects on growth rates and coordination were noted only in the one week-old birds, especially those of the scaleless line. (Author abstract by permission)

74-2469. Schom, C. B.; Abbott, U. K.; Walker, N. (Dept. Avian Sci., Univ. California, Davis, CA 95616). **Organophosphorus pesticide effects on domestic and game bird species: Dursban.** *Poultry Sci. 52(5): 2083; 1973.*

Dursban (chlorpyrifos) (technical standard) was fed to adult birds (100 ppm) or injected (analytic standard) into the yolk sac of 96 hr. embryos. Comparisons were made between treated and control birds within species and between three species, chicken, Chukar and Bobwhite quail. Chicken hens receiving Dursban had residues of 0.126 ppm in yolk. The pesticide did not significantly affect egg production, egg weight or mortality. Fertility was reduced by 15% and hatchability by 17% from that of controls. Chukar and quail hens had lower residues, 0.035 ppm and 0.043 ppm, respectively, in egg yolks. No adverse effects on reproductive characteristics were observed. In fact, hatchability was higher in treated Chukars than in controls. When the level of Dursban in quail feed was raised, mortality increased: with 200 ppm for 98 days, 2 of 18 birds died; with 500 ppm for 91 days, 3 of 18 died, and with 600 ppm for 62 days, 7 of 18 died. Chicken eggs for the injection study were from a commercial supplier; the Chukar and quail eggs were from control populations reared at U.C.D. When chicken egg yolks were injected with 1.0 mg Dursban/egg, the embryos developed twisted necks, indented backs and occasionally edema. Chukar embryos (yolk injected with 0.47 mg Dursban/egg) had shortened backs and twisted necks. Bobwhite quail embryos (yolk injected with 0.35 mg Dursban/egg) developed twisted necks and amuscular legs. (Author abstract by permission)

74-2470. Wilson, H. R.; Thompson, N. P.; Roland, D. A. (Dept. Poultry Sci. and Food Sci., Univ. Florida, Gainesville, FL 32601). **The effect of oral doses of DDT on various physiological parameters in the bobwhite laying hen.** *Poultry Sci. 52(5): 2103; 1973.*

Bobwhite quail hens, 14 months of age and in the seventh month of lay, were paired with males of the same age and randomized into single pair breeder cages with twenty-two hens per treatment. The hens were dosed by gelatin capsule twice weekly with 0 DDT, 10 mg DDT, or 20 mg DDT. The experimental period consisted of two weeks pre-treatment, four weeks treatment, and two weeks recovery for those not sacrificed at the end of treatment. Egg production, hen body weight, hen mortality, and chick weight as percent of egg weight were not affected by the treatments. The 20 mg dosage treatment resulted in decreased egg weight, shell thickness, shell membrane thickness, fertility, hatchability and serum calcium. In addition, yolk mottling was greater and weight loss of infertile eggs held under incubation conditions was greater for those birds dosed with 20 mg DDT. DDT was present in the feces in high levels the day of and day following dosing, but was absent on the second day after dosing. After four weeks of dosing, the birds which received 10 mg DDT had brain, liver and body fat DDT levels of 2.26, 11.38 and 107.15 ppm wet weight, respectively, while those which received 20 mg DDT had 3.24, 29.39 and 158.83 ppm wet weight, respectively. The maximum egg yolk DDT observed was 124.92 ppm wet weight in eggs from birds dosed with 20 mg DDT. This level decreased to 60.47 ppm and 27.59 ppm on the ninth and 16th days, respectively, after the last dose. (Author abstract by permission)

74-2471. Britton, W. M.; Palmer, M. B.; Howarth, B., Jr. (Dept. Poultry Sci., Univ. Georgia, Athens, GA 30602). **Fertility, hatchability and progeny performance of laying hens fed high levels of DDT in the diet.** *Poultry Sci. 53(3): 1053-1055; 1974.* (6 references)

Three groups of White Leghorn hens were fed a commercial laying ration supplemented with 0, 300 or 600 ppm technical DDT for 93 days prior to and during a 40 day measurement period. Fertility, hatchability, chick mortality, chick body weight and chick liver and adipose tissue DDT residues were studied. Egg production was reduced by both 300 and 600 ppm in the hens' diet. Fertility was significantly reduced in the 300 but not in the 600 ppm group when compared to the 0 ppm group. There were no significant differences in the hatchability of fertile eggs. Chick mortality was significantly increased in the 300 (7.6% mortality) and 600 ppm (76.5% mortality) groups, and chick body weight was significantly decreased in both DDT groups. The majority of the chick mortality in the 600 ppm group occurred in the first three days after hatching. Concentration of DDT residues in chick liver and fat increased as the DDT ingestion by the hens increased. (Author abstract by permission)

74-2472. Latimer, J. W.; Siegel, H. S. (Southeast Poultry Res. Lab., Agr. Res. Serv., Athens, GA 30601). **Immune response in broilers fed technical grade DDT.** *Poultry Sci. 53(3): 1078-1083; 1974.* (15 references)

Four experiments were conducted using White Rock males. Beginning at four weeks of age, mash containing levels of technical grade DDT up through 625 ppm was fed ad lib. At six weeks the chicks were inoculated intravenously with either killed *Salmonella pullorum* (SP) or a purified Bovine Serum Albumin (BSA) antigen. SP antibody titers were determined on sera collected every 48 hours for two weeks and BSA antibody titers were measured using sera collected every 72 hours for a three-week period. Under the conditions of these experiments, ingestion of technical grade DDT did not consistently influence the antibody titers to SP or BSA of these chickens. At only the sixth day post-inoculation of one experiment was there a difference among treatments. At that time SP titers were significantly higher in birds receiving 50 ppm than in those receiving 0 or 500 ppm DDT. In a fifth experiment 0 to 2700 ppm technical grade DDT was fed to four-week-old chicks. All birds fed 2700 ppm died within 12 days after starting on the treated feed. Despite outward signs of toxicity in birds fed 900 ppm a significant difference in antibody response to SP antigen was not observed. (Author abstract by permission)

74-2473. Crone, H. D. (Australian Defense Sci. Serv., Defense Standards Lab., Melbourne, Victoria, Australia). **The influence of allosteric effectors on the ageing of phosphonylated acetylcholinesterase.** *Proc. Aust. Biochem. Soc. 6: 25; 1973.* (2 references)

Pralidoxime can reactivate acetylcholinesterase inhibited by organophosphate compounds such as sarin, but the degree of reactivation decreases with time after poisoning. This aging process with sarin comprises loss of the isopropyl group from the enzyme-inhibitor complex. The effect of quaternary nitrogen compounds on the aging of inhibited enzyme was investigated, since these have been shown to constitute allosteric effectors of AChE. The most effective compound examined was alloferin (diallyl-bis-nortoxiferine dichloride), which increased the half-life of unaged phosphonylated AChE from 2.9 hr to 8.7 hr under the experimental conditions. Gallamine and tubocurarine were effective in inhibiting aging at higher concentrations, and even sodium chloride inhibited aging at high concentrations. The practical usefulness of these findings has not yet been established.

74-2474. Addison, R. L.; Willis, D. E.; Darrow, D. C. (Fish. Res. Board Can., Mar. Ecology Lab., Belford Inst. Oceanogr., Dartmouth, Nova Scotia, Canada). **Metabolism of biphenyl by skate, *Raja radiatae*.** *Proc. Can. Fed. Biol. Soc. 16: 39; 1973.*

Biphenyl was metabolized in vitro by skate (*Raja radiata*) liver to 4-hydroxybiphenyl (major metabolite) and to 2-hydroxybiphenyl. Fluorimetric, TLC, and GLC methods were used to detect the compounds. Intravenous administration of biphenyl to skate resulted in excretion of 4-hydroxybiphenyl in the urine.

74-2475. Korte, F. (Inst. fuer Oekologische Chemie, Gesellschaft fuer Strahlen- und Umweltforschung, Schloss Birlinghoven/Siegkreis, Germany). **Recent results of investigations in environmental chemistry.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 3-14.*

Aldrin-6,7-transdiol, the main rabbit metabolite of aldrin-dieldrin, is further metabolized in rats by ring closure to the dicarboxylic acid, prillic acid. Aldrin-6,7-diol was metabolized by microorganisms to a conjugate of prillic acid and other unidentified compounds. Photodieldrin was metabolized in insects to a compound chromatographically identical to a known rat-urine metabolite of dieldrin. No conversion of dieldrin or endrin was detected in *Chlorella*, but heptachlor was converted to hydrophilic metabolites and heptachlor epoxide. DDT applied to spinach and cabbage leaves was 10% converted to TDE and DDE. DDE conversion rate on cabbage was 1%, whereas TDE conversion was greater than 10%. Lindane was converted to *gamma*-pentachlorocyclohexane (PCCH), 1,2,4- and 1,2,3-trichlorobenzene in corn and PCCH and 1,2,4-trichlorobenzene in bean. However, major hydrophilic metabolites remain unidentified. Maximum total residues of heptachlor in cabbage and wheat were 8%, the products being heptachlor epoxide, 1-hydroxy-2,3-epoxichlordene, 1-hydroxychlordene, chlordene, chlordene epoxide, and hydrophilic compounds. *Delta*-ketoendrin is the major metabolite of endrin in cabbage. Aldrin, tested under practical conditions on maize, sugarbeet, and wheat, left highest residues in maize leaves, beet peels and in the soil at a depth of 10-20 cm. DDT changes slowly in sunlight to DDE, *p,p'*-dichlorobenzophenone, *p*-chlorobenzoylchloride, *p*-chlorobenzoic acid and *p*-chlorophenyl-*p*-chlorobenzoate. Methoxychlor yields analogous products. DDE forms *p,p'*-dichlorobenzophenone, 1-chloro-2,2-bis(*p*-chlorophenyl)ethylene and 1-chloro-2-*p*-chlorophenyl-1-2-*p*-*o*(*m*)-dichlorophenylethylene. Irradiation of polychlorinated biphenyls results in successive dechlorination. The herbicide Prefix (chlorthiamid) is converted to the nitrile Casoron (dichlobenil), which in turn is dechlorinated, but the nitrile group is not hydrolyzed.

74-2476. Bull, D. L. (Entomol. Res. Div., Agr. Res. Serv. USDA, College Station, TX). **Metabolism of organophosphorus insecticides in plants.** *IN: Radiotracer Studies on Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 25-33.* (20 references)

The metabolism of organophosphorus insecticides

in cotton plants involves different enzyme-catalyzed reactions, the products of which may be harmful. Oxidative desulfuration of ^{32}P-labeled Geigy GS-13005 (methidathion) was minor. Concentrations of the oxygen analog were 3% of applied dose one day after treatment, then declined thereafter. Bay 93820 residues were essentially depleted in 32 days. The oxygen analog concentration was 9% a day after treatment and declined steadily thereafter. The oxygen analogs of GS-13005 and Bay-93820 showed 10,000-fold and 20,000-fold respective increases in anticholinesterase activity over the parent compounds. 53% of ^{32}P-labeled Allied GC-6506 (dimethyl *p*-(methylthio)phenyl phosphate) was immediately converted to the sulfoxide; the sulfone concentration never exceeded 4% of the dose. All toxicants were depleted in 16 days; 93.1% of the applied dose of ^{32}P-labeled disulfoton was in the sulfoxide form in isolated cotton leaves immediately after application. *N*-demethylation of ^{32}P-labeled and ^{14}C-labeled dicrotophos results in formation of the glucoside of hydroxymethyl dicrotophos, an important detoxification step. However, the products formed by oxidative *N*-deethylation of phosphamidon in plants and animals are toxic. The major portion of the substituted phenolic moiety of the GC-6506 molecule was represented by glucosidic conjugates of substituted phenols. Significant levels of trichlorfon and the toxic hydroxylated metabolites of monocrotophos and dicrotophos were incorporated directly into glucosidic conjugates in plants.

74-2477. Tomizawa, C.; Uesugi, Y.; Murai, T. (National Institute of Agricultural Sciences, Tokyo, Japan). **Fate and significance of fungicides in rice.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 103-105.*

The metabolic fate of labeled Kitazin-P and Hinosan is given in rice blast fungus, Wistar rat, soil, American cockroach, and rice plant. Major degradative reactions included hydrolysis by cleavage of the P-S linkage in Hinosan and mainly the S-C linkage but also the P-S linkage in Kitazin-P. Oxidation of phenylthio- and benzylthio- radicals resulted in such compounds as diphenyl disulfide, dibenzyl disulfide, benzene sulfonic acid, benzyl-alpha-sulfonic acid, and sulfuric acid. In some cases, *p*-hydroxylation of the phenylthio- ring and *m*-hydroxylation of the benzylthio- ring were found. Thiolate isomerization to thionate in Kitazin-P was detected.

74-2478. Alumot (Olomucki), E.; Harduf, Z. (Division of Animal Nutrition, Volcani Institute of Agricultural Research, Rehovot, Israel). **Use of radioisotopes for the study of ethylene dibromide action on laying hens.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 123-127.* (8 references)

The passage of ^{125}I- and ^{131}I-labeled chick serum globulin (CSG) and albumin (CSA) and ^{125}I-labeled polyvinyl pyrrolidone (PVP) from serum to yolk was studied to test the possibility of ethylene dibromide (EDS) causing impaired transport through the follicular membranes. The maximum uptake per whole yolk, as well as per unit of membrane area, of labeled proteins in EDB-treated hens was about half that of controls. In another trial in which two hens were killed 40 hours after injection, there was a trend of lower CSA uptake in the EDB-treated hen. Follicles in EDB-treated hens appear to take up less radioactivity in the last stages of growth than do controls. The uptake of labeled inorganic phosphate and labeled PVP in EDB-treated hens was about half that of controls. The lowered uptake of macromolecules seems to be connected with the affected permeability of the follicular membrane.

74-2479. Horler, D. F. (Min. of Agr., Fisheries and Food, Pest Infestation Control Laboratory, Slough, Buckinghamshire, England). **Note on recovery of ^{14}C-labelled malathion from aged samples of wheat grain.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 143.*

^{14}C-labeled malathion was applied to wheat to give a total residue of 10 ppm. Two days after treatment 93 and 92% of ^{14}C was extracted in *n*-hexane, and 85 and 84% was extracted in methanol. At two months after treatment 56 and 53% was extracted in *n*-hexane and 64 and 72% in methanol. In samples aged two months 83 and 76% of radioactivity was methanol-extracted from wheat of 20% moisture content, decreasing to 60 and 73% from wheat of 10% moisture content; 34 and 29% was extracted on *n*-hexane from wheat of 20% moisture content, increasing to 73 and 75% in wheat of 10% moisture content.

74-2480. Overman, A. J. (Univ. Florida, IFAS AREC, Bradenton, FL). **The effect of fumigants on non-target soil microorganisms in tomato seedbeds.** *Soil Crop Sci. Soc. Fla. 31: 256-260; 1972.* (6 references)

Three chemicals used as soil fumigants on tomato seedbeds temporarily modified the structure of the non-target microbial community in Myakka fine sand and Manatee fine sandy loam. Chloropicrin (CP) (80 gal/acre), methyl bromide (MBr) (2 lb/100 sq ft), and allyl alcohol (AA) (60 gal/acre) established for more than 30 weeks a soil environment favorable for the rapid proliferation of *Trichoderma* sp. from propagules which survived treatment. Nitrification in the sand was suppressed for 50 days following treatment with DP and MBr. In CP and MBr treated plots of both soil types there was a period of heightened bacterial activity three weeks after fumigation. Ethylene dibromide (5 gal/acre) did not significantly affect nontarget organisms. The soil fumigants had no effect on the density of actinomycetes in either soil type two weeks after fumigation.

74-2481. Watanabe, I. (Faculty Agr., Iwate Univ., Morioka, Japan). **Isolation of pentachlorophenol decomposing bacteria from soil.** *Soil. Sci. Plant. Nutr. 19(2): 109-116; 1973.* (10 references)

The bacteria capable of degrading pentachlorophenol (PCP) were isolated from paddy soil perfused with a solution containing 40 ppm of PCP. PCP was decomposed, and five chlorine atoms from PCP were liberated as chloride ion after about three weeks. The re-addition of PCP after its degradation accelerated the rate of PCP degradation and dechlorination. Bacteria which grew on PCP agar reached a concentration of 2×10^7/gm dry soil after three applications of PCP to the soil. PCP degradation and dechlorination took place following the inoculation of liquid medium with the perfused soil; the bacteria capable of growing on PCP agar multiplied under these conditions. Bacteria capable of growing on and degrading PCP in media containing inorganic salts and 40 ppm PCP as the sole source of carbon were isolated. From their morphological and physiological characteristics they appeared to be of or closely related to the genus *Pseudomonas.* During the degradation of PCP by these organisms, the dechlorination process corresponded approximately with the disappearance of PCP.

74-2482. Suteu, D.; Cristea, A. (Cent., Cercet. Biol., Cluj, Rumania). **Efectele unor insecticide organofosforice asupra Ca, P, colesteroluliu si N aminic liber sanguin la gaini. [Effects of some organophosphorus insecticides on Ca, P, cholesterol, and free amino nitrogen in chicken blood.]** *Stud. Cercet. Biol. Ser. Zool. 24(5): 437-442; 1972.* (19 references) (Rumanian)

The influence of two organophosphorus insecticides, Carbetox (malathion) and fenchlorfos (ronnel), on the blood levels of Ca, P, free amino nitrogen, and cholesterol was investigated on Leghorn hens maintained four weeks on a diet containing small amounts of the pesticides. The results showed a remarkable decrease of Ca in plasma and tissues; strong correlations were found between P and Ca, Ca and proteins, Ca and sugars, and Ca and lipids. Although no explanation is available at present, the results show a significant change in Ca, P, and free amino nitrogen in blood, a fact that emphasizes the influence of the two insecticides in altering the mineral and amino acid metabolism in hens.

74-2483. Strik, J. J. T. W. A.; Wit, J. G. (Inst. Vet. Pharmacol. Toxicol., Utrecht, The Netherlands). **Hepatic porphyria in birds and mammals.** *TNO-Nieuws 27(10): 604-610; 1972.* (32 references)

Porphyrias are characterized by excessive production, accumulation, and excretion of porphyrin precursors (such as δ-aminolevulinic acid and porphobilinogen) and/or porphyrins (uroporphyrin, coproporphyrin and protoporphyrin) and by red fluorescence in blue-violet light (400 nm). The compounds allylisopropylacetamide (AIA) (400 mg/kg/day), diethyl-1,4-dihydro-2,4,6-trimethylpyridine-3,5-dicarboxylate (DDC)(1000 mg/kg/day), and hexachlorobenzene (HCB)(1000 mg/kg/day) were given orally to Japanese quail, and δ-amino levulinic acid synthetase (ALAS) activity and red fluorescence determined in liver. After AIA administration, microscopic fluorescence appeared in liver after 3 days, was maximum at 10 days, and still continued after 50 days. ALAS activity after 3 and 10 days was 3-4 times that of controls. After DDC administration, liver fluorescence was observed only during the 160 day experimental period, and ALAS activity was 6-8 times that of controls. With HCB, fluorescence was not regularly detected during the experimental period. The ALAS activity was twice that of controls. HCB evokes a hepatic cytoplasmic uroporphyria associated with weight loss, tremor and mortality, and has a slow onset of action, while AIA and DDC evoke a hepatic protoporphyria not associated with weight loss or mortality and both produce changes within hours after administration.

74-2484. Leeuwangh, P. (Inst. Vet. Pharmacol. Toxicol., Utrecht, The Netherlands). **Limitations in the use of enzyme induction as a parameter for the assessment of environmental effects of pesticides.** *TNO-Nieuws, 27(10): 611-616; 1972.* (7 references)

In vitro studies on the hydroxylation of biphenyl and coumarin by various birds showed great species variation. Studies on the development of biphenyl-2-, -4-, and coumarin-7-hydroxylation in Japanese quail showed that enzyme activity generally increased with age through 12-day-old embryos to 6-month-old adults, was greater in adult males than adult females, and was greater in animals starved four days than in those fed normally. HCB (2000 mg/kg) and lindane (10 mg/kg) caused different degrees of enzyme induction and caused different microsomal levels of cytochrome P450 and NADPH-cytochrome-c-reductase. Therefore, because of the wide variety of factors, endogenous and exogenous, which can influence enzyme induction, its use as a parameter for the assessment of environmental effects of pesticides can be used reliably, only if a homogenous population is tested to overcome genetic factors, b) the population is distributed at random in an exposed and unexposed group of equal sexes, c) except for the chemical to be tested all other factors which affect drug metabolism are stabilized, d) the enzyme assay is performed with a suitable substrate under previously standardized conditions, and e) the results are tested statistically.

74-2485. Nagasaki, H.; Tomii, S.; Mega, T.; Marugami, M.; Ito, N. (Dept. Hygiene, Nara Med. Univ., Nara, Japan). **Carcinogenicity of benzene hexachloride.** *IN: Topics in Chemical Carcinogenesis. University Park Press, Baltimore, 1972, p. 343-353.* (24 references)

Male dd-mice were maintained for 24 weeks on

basal diets containing 0 (Group 4), 6.6 (Group 3), 66 (Group 2), or 660 (Group 1) ppm of technical benzene hexachloride (BHC). Although the Group 1 mice lost weight during the first 4 weeks, after 12 weeks they weighed more than any of the other groups. Food consumption decreased as a function of the amount of BHC fed. The livers of the mice in Groups 1, 2, and 3 weighed more than those of the Group 4 animals. All of the Group 1 animals developed liver tumors; none of the other mice developed tumors. The liver nodules of the Group 1 mice were hyperplastic nodules and hepatomas. The Group 2 animals developed hypertrophic foci of the liver parenchymal cells in the centro-lobular areas. The livers of the Group 3 and 4 mice were histopathologically normal. The other organs were essentially normal in all groups. The Group 1 animals accumulated large amounts of the α- and β-isomers of BHC in the liver. The Group 2 animals accumulated about 10% of the amounts of these isomers accumulated by Group 1, and the Group 3 animals accumulated about 20% of the amounts accumulated by Group 2. In all groups, the γ- and δ-isomers were present in only trace amounts. (From Proceedings of the 2nd International Symposium of the Princess Takamatsu Cancer Research Fund, Tokyo, 1971)

74-2486. Lishenko, N. P.; Lishenko, I. D. (Dept. Botany, Zhitomir Inst. Pedagogy, Zhitomir, USSR). **Deystviye parov granozana na mitoz. [Effect of granosan (ethyl mercuric chloride) vapors on mitosis.]** *Tsitologiya 16(4): 515-516; 1974.* (2 references) (Russian)

The long-term effects of granosan vapors on mitosis were studied in vetch seeds. The dry seeds were kept in 180 cm^3-flasks containing 0.4 qr 2 g granosan without any contact between the fungicide and the seeds at 16-24 C for 13 months. Total suppression of mitosis, sharp decline in the viability, consequent polyploidy of the cells, and abnormal distribution of the chromosomes in the anaphases due to the effect of granosan vapors were determined.

74-2487. Viyevskiy, N. A. (Dept. Pathol. Physiol. and Pathol. Anat., Vinnitsa Med. Inst., Vinnitsa, USSR). **Sravnitel'naya kharakteristika allergennogo deystviya nekotorykh pestitsidov v eksperimente. [Comparative experimental characterization of the allergenic effect of some pesticides.]** *Vrach. Delo 5: 126-130; 1974.* (9 references) (Russian)

The allergenic effects of polychloropinene, ethylmercury chloride, and trichlorfon were studied in guinea pigs and albino rabbits. The guinea pigs were sensitized by s.c., intratracheal or oral administration of doses corresponding to 0.01 and 0.0001 or 100% of the respective maximum allowable concentrations in the air on six occasions at 2-3 day intervals. The rabbits were sensitized by skin application and s.c. administration. Polychloropinene was a moderate allergen, and ethylmercury chloride possesses low allergenic activity. Trichlorfon showed no allergenic properties. Humoral antihapten antibodies and biogenic amines participated actively in the development of toxic allergic reactions of the immediate type. The degree of allergization depended on the dose or routes of entry. Toxic doses of the allergens inhibited the specific sensitization and thus induced the autoantibody formation. The pesticides studied may cause skin allergic reactions of the delayed type due to the participation of antihapten fixed antibodies as well as to circulating and lymphocyte-fixed anticutaneous autoantibodies.

74-2488. Ferebee, R. N.; Guthrie, R. K. (Dept. Microbiol. Med. Technol., Univ. Arizona, Tucson, AZ). **The effects of selected herbicides on bacterial populations in an aquatic environment.** *Water Resour. Bull. 9(6): 1125-1135; 1973.* (12 references)

Laboratory cultures of heterotrophic, mesophilic bacteria derived from and maintained in a freshwater environment were treated with water soluble solutions of diuron, 2,4,5-T, and paraquat in concentrations of 0.7 to 1.4 mg/l. Alterations in the types and numbers of the bacteria, which represented several genera, were monitored, as were the temperature, pH, and dissolved oxygen of the water. Paraquat increased bacterial counts; diuron reduced the total bacterial counts and caused selective enrichment. 2,4,5-T had no effects on the bacterial populations tested. None of the herbicides was completely degraded in the laboratory culture system after three weeks. Both diuron and paraquat reduced the number of algae in the cultures tested.

74-2489. Hodgson, R. H.; Dusbabek, K. E.; Hoffer, B. L. (Metabolism and Radiation Res. Lab., N. Cent. Reg., Agr. Res. Serv., U.S. Dept. Agr., Fargo, ND 58102). **Diphenamid metabolism in tomato: time course of an ozone fumigation effect.** *Weed Sci. 22(3): 205-210; 1974.* (10 references)

The time course of diphenamid (*N,N*-dimethyl-2,2-diphenylacetamide) metabolism in tomato (*Lycopersicon esculentum* Mill. 'Sheyenne') was altered by fumigation with 30 pphm (parts per hundred million) of O_3. After 2 days 70% of the absorbed diphenamid was metabolized in controls compared with 83% in fumigated plants. Concentrations of *N*-methyl-2,2-diphenylacetamide (MMDA) were equivalent in both fumigated and control plants. Less glucoside conjugate (MDAG) was present in fumigated plants 2 to 4 days after treatment than in the control plants. Gentiobioside conjugate (MDAGB) increased rapidly in fumigated plants after 0.5 day but not in control plants until after 2 days. Loss of diphenamid from aerated solution was demonstrated. A scheme for diphenamid metabolism is proposed. (Author abstract by permission)

74-2490. Hargroder, T. G.; Rogers, R. L. (Louisiana Agr. Exp. Sta., Louisiana State Univ., Baton Rouge, LA 70803). **Behavior and fate of metribuzin in soybean and hemp sesbania.** *Weed Sci. 22(3): 238-245; 1974.* (20 references)

The absorption, translocation, and metabolism of metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4H) one] by soybean (*Glycine max* Merr. 'Lee 68') and hemp sesbania (*Sesbania exaltata* L.) grown in nutrient solution and in soil treated with ^{14}C-metribuzin were investigated. Absorption studies indicated there were no significant differences in the amount of ^{14}C-metribuzin absorbed from treated nutrient solution by soybean (tolerant) and hemp sesbania (susceptible). When these species were grown in ^{14}C-metribuzin treated soil, hemp sesbania absorbed appreciably more herbicide than did bean. ^{14}C-Metribuzin and (or) its ^{14}C-metabolites were translocated from the roots to the shoots of both species. Radioactivity was rapidly translocated and accumulated in all the leaves of hemp sesbania, but it tended to accumulate to the greatest extent in the roots and lower leaves of soybean. Translocation differences between the two species were apparent in plants grown either in soil or nutrient solution treated with ^{14}C-metribuzin. However, differences were greatest in plants grown in treated soil. Preliminary metabolic studies indicated that a higher rate of metribuzin degradation occurred in soybean than in hemp sesbania. The major ^{14}C-metabolite appeared to be the relatively non-phytotoxic deaminated diketo derivative [6-*tert*-butyl-1,2,4-triazine-3,5(2H,4H)dione]. Thus, differences in the absorption, translocation, and metabolism of metribuzin all appeared to contribute to the differential susceptibility of soybean and hemp sesbania to metribuzin. (Author abstract by permission)

74-2491. Meikle, R. W.; Youngson, C. R.; Hedlund, R. T.; Goring, C. A. I.; Addington, W. W. (Dow Chemical Co., Ag-Organics Res. Lab., Walnut Creek, CA 94598). **Decomposition of picloram by soil microorganisms: a proposed reaction sequence.** *Weed Sci. 22(3): 263-268; 1974.* (18 references)

The 6-hydroxy derivative of picloram (4-amino-3,5,6-trichloropicolinic acid) is not on the main pathway of the soil microbial decomposition sequence for picloram. Rather it may be formed in very small amounts in a competing reaction. Decarboxylation of picloram cannot be the initial reaction in this sequence and, in fact, does not occur. (Author abstract by permission)

74-2492. McClure, G. W. (Boyce Thompson Inst. Plant Res., Yonkers, NY 10701). **Degradation of anilide herbicides by propham-adapted microorganisms.** *Weed Sci. 22(4): 323-329; 1974.* (17 references)

A mixture of microorganisms cultured under nonsterile conditions on propham (isopropyl carbanilate) herbicide as the sole carbon source was tested for its ability to degrade a number of chlorinated and nonchlorinated anilide compounds. In separate tests under pure-culture conditions, species of the microbial mixture reacted individually in a manner similar to the nonsterile wh[redacted]The microorganisms grew and respired rapidly on nonchlorinated anilides, but ring chlorination depressed respiration and inhibited growth. Studies on the dimethylphenylureas indicated that the two methyl groups were primarily responsible for the biological stability of these compounds. All other anilides were degraded by hydrolysis of the side chain followed by metabolic degradation of the ring. Appearance of aniline in the medium depended on the relative rates of production by side chain hydrolysis and disappearance by ring degradation. Acylanilides were hydrolyzed more rapidly than carbanilates and chlorinated rings were degraded much more slowly than unchlorinated rings. Chlorination affected rates of ring degradation and microbial respiration in the following order (most rapid to least rapid): 0> 2,4 > 2,4,5 > 3 > 4> 3,4. It is proposed that this unexpected degr[illegible]lative sequence might be explained in terms of the degree of microbial toxicity in the system generated by the formation of chloroazobenzenes from chloroaniline intermediates. (Author abstract by permission)

74-2493. Valentine, J. P.; Bingham, S. W. (Dept. Plant Pathol. Physiol., Virginia Polytech. Inst. and State Univ., Blacksburg, VA 24061). **Influence of several algae on 2,4-D residues in water.** *Weed Sci. 22(4): 358-363; 1974.* (17 references)

Removal of [2-^{14}C] 2,4-D [(2,4-dichlorophenoxy)-acetic acid] from water was pronounced with *Scendesmus quadricauda* (Turp.) Breb. and most effective uptake occurred at pH 4.7. Three other algae were relatively ineffective in removal of 2,4-D. Increasing *Scenedesmus* cell density increased 2,4-D removal, but the amount absorbed was not a linear function of cell density. Similarly, with a range of herbicide concentrations (0.01 to 1.0 ppmw) the amount removed was greatest at the highest concentration; however, a higher percentage of chemical was removed at lower concentrations. An equilibrium of ^{14}C removal from water and ^{14}C released to the water was reached by 4 hr. More herbicide was removed from water by *Scenedesmus* in darkness than in light and low temperature (2 C) reduced uptake slightly. Relatively high 2,4-D concentrations were required to reduce growth in any of the four algae and *Scenedesmus* was most sensitive. *Scenedesmus* metabolized [*ring*-^{14}C] in 24 hr to several products which were found in suspension fluid and cells. Quantitatively, 3-OH-2,4-D [3-hydroxy-2,4-dichlorophenoxy)-acetic acid] was the major metabolite, comprising 26% of the radioactivity extracted from cells compared to 15% from suspension fluid. A smaller amount of 5-OH-2,4-D [(5-hydroxy-2,4-dichlorophenoxy)acetic acid] was isolated from the suspension fluid and none from the cells. (Author abstract by permission)

74-2494. Kohli, J. D.; Khanna, R. N.; Gupta, B. M.; Dhar, M. N.; Tandon, J. S.; Sircar, K. P. (Industr. Toxicol. Res. Cent., Lucknow, India). **Absorption and excretion of 2,4-dichlorophenoxyacetic acid in man.** *Xenobiotica 4(2): 97-100; 1974.* (3 references)

The absorption and excretion of 2,4-dichlorophenoxyacetic acid (2,4-D) were studied on six human volunteers. A weighted amount of 2,4-D was administered in a gelatin capsule with water (oral ingestion 5mg/kg) and the men were allowed a free-choice diet. None of the persons involved in the experiments complained of any ill effects after the ingestion of 2,4-D. Clinical and laboratory results did not show any specific changes. Absorption of 2,4-D is rapid with 2,4-D appearing in plasma one hour after ingestion. Seventy-five percent of the 2,4-D consumed had been excreted in urine unchanged 96 hours after ingestion. Although some individual changes were detected, 2,4-D was absorbed and excreted through the kidneys, and metabolic transformations were not observed in the body.

74-2495. Schwartze, G.; Wichmann, T.; Schmidt, R. (Hautklinik, Martin-Luther–Universitaet, Halle-Wittenberg, DDR). **Untersuchungen zum Porphyrinstoffwechsel bei experimenteller Porphyrie. [Porphyrin metabolism in experimental porphyria.]** *Z. Gesamte Inn. Med. Ihre Grenzgeb. 28(16): 501-504; 1973.* (40 references) (German)

Hepatic and enzymatic changes were studied in female mice with hexachlorobenzene-induced porphyria. The animals were fed diet containing 0.6% hexachlorobenzene corresponding to a daily intake of approximately 15 mg for 12 weeks. Focal alopecia, slight tremor, and vascularization of the liver were observed as early as three weeks after the start of the treatment. Enzymatic investigations revealed signficant increases in the 5-aminolevulinic acid synthetase activity in the liver and in the glutamate oxalacetate transaminase in the serum (SGOT). Glutamate pyruvate transaminase (GPT) and alkaline phosphatase showed a slight, non-significant increase in activity.

See also 74-2294 74-2333 74-2335 74-2342 74-2496 74-2518 74-2523

74-2496. Pozsar, B. I. (Inst. Agrobotany, Tapioszele, Hungary). **Can the nodulation bioassay of papilionaceae be used for testing the level of pesticide (fungicide) residues in the soil?** *Acta Agron. (Budapest) 22(3-4): 466-467; 1973.*

The nodulation bioassay of *Papilionaceae* can be used to evaluate the damaging effects of fungicides on the microbial activity of the soil. The nodulation organisms are able to reduce molecular nitrogen directly by means of reduced NAD and NADP coenzymes; the reduction proceeds via proton transfer processes. The degree of nitrogen fixation and the inhibition of metabolism in the nodulation organisms provide direct quantitative data for determining the level of chemical residues in the soil. Correlation between nodulation inhibition and pesticide residues involves multifactorial analysis in which synergic effects may play a role. The application of fungicides to *Rhizobium* grown on synthetic culture media can increase general and special fungicide tolerance in the nodulation organisms and reveal the extreme types of fungicide resistance. The identification of chemicals with an especially high degree of toxicity and the systematic planning of fungicide rotation will aid in protecting the environment through an integrated view of plant protection.

74-2497. Vernon, F. (Dept. Chem. Appl. Chem. Univ. Salford, Salford, M5 4WT, Lancs., England). **The fluorimetric determination of triphenyltin compounds.** *Anal. Chim. Acta 71(1): 192-195; 1974.* (5 references)

The very high sensitivity and selectivity of this method together with the fact that the toxic triphenyltin moiety is determined directly, suggests that it will prove to be a most useful technique in triphenyltin residue analysis. Stoner's suggested figure for a maximum daily intake of triphenyltin can be interpreted as 0.07 mg per day for a person weighing 70 kg. If the maximum daily diet were to include 1 kg of potato, the tin present as triphenyltin should not therefore be greater than 0.027 ppm. Of the six samples analyzed, three were approximately one tenth of this maximum but these samples had been treated with three times the recommended dosage. It appears likely, therefore, that triphenyltin formulations can be used safely in the control of potato blight. Extensive trials will be required but it is suggested that this method will allow the determination of triphenyltin residues at the required level. (Author abstract by permission)

74-2498. Murti, P. S.; Bala Bhaskara Rao, G.; Krishna Rao, P. V. (Dept. Chem., Andhra Univ., Waltair, India). **A spot test for the detection of some aromatic hydrazides.** *Anal. Chim. Acta 71(1): 202-204; 1974.* (10 references)

Because of the extensive use of aromatic hydrazides in chemotherapy, in fungicides and in pesticides, their detection and determination is of considerable importance. While many spot tests have been reported for the detection of isonicotinic acid hydrazide, very few tests are available for other aromatic hydrazides. Larue proposed trinitrobenzenesulfonic acid for the detection of benzoic acid hydrazide, its *m*- and *p*-nitro derivatives, salicylic acid hydrazide and phenylacetic acid hydrazide. In a recent communication, 2,3,5-triphenyltetrazolium chloride has been proposed for the detection of some aromatic hydrazides in the presence of compounds of similar composition and anions such as chloride, bromide, sulfate, nitrate, acetate, oxalate and citrate. In this communication, potassium hexacyanoferrate(III) or potassium hexacyanoferrate(II) is proposed for the detection of some aromatic hydrazides. The test is very simple and the reagents are inexpensive. (Author abstract by permission)

74-2499. Manning, R. J. (Beckman Instruments G.m.b.H., Munich, Germany). **Die Infrarotspektroskopie als Hilfsmittel zum Nachweis von Verunreinigungen in Luft, Wasser und Abwasser. [Infrared spectroscopy in the detection of impurities in air, water, and waste water.]** *Beckman Rep. 1: 36-42; 1973.* (5 references) (German)

The possible applications of the infrared spectrophotometer in the detection and identification of groups of organic compounds or individual compounds in air, water, and wastewater are presented. The operating range of the IR spectrophotometer is between 600 and 4,000/cm. Mixtures of various organic contaminants can be separated by adsorption on activated carbon and subsequent extraction with chloroform. Spectrograms for oils, solvents, DDT, dieldrin and parathion in water are presented. Potassium bromide discs are generally used for the detection of pesticide residues.

74-2500. Gulan, M. P.; Bills, D. D.; Putnam, T. B. (Dept. Food Sci. Technol., Oregon St. Univ., Corvallis, OR 97331). **Analysis of polychlorinated naphthalenes by gas chromatography and ultraviolet irradiation.** *Bull. Environ. Contam. Toxicol. 11(5): 438-441; 1974.* (5 references)

An ultraviolet (uv) irradiation method for the identification of certain chlorinated insecticides (CIs) was applied to the analysis of polychlorinated naphthalenes (PCNs). The method involved trapping the component as it eluted from the gas chromatograph (GC), exposing it to laboratory uv light, and rechromatographing the resulting products. Separation of Halowax 1014 (a PCN) solution yielded 13 major peaks, the retention times of some of which corresponded to those of heptachlor, aldrin, heptachlor epoxide, *o,p'*-DDE, *p,p'*-DDE, dieldrin, *o,p'*-DDT, *o,p'*-DDD (TDE), and Aroclor 1254. Using the optimum irradiation times for each of the PCN components, each 1014 peak gave a characteristic fingerprint degradation pattern. In general, the less chlorinated compounds required a longer time to

degrade than the more highly chlorinated compounds. The interfering insecticides could be easily distinguished from the Halowax peaks since each insecticide gave a degradation product that was largely resolved from the PCB degradation products and vice versa.

74-2501. Bidleman, T. F.; Olney, C. E. (Dept. Food Resource Chem., Univ. Rhode Island, Kingston, RI 02881). **High-volume collection of atmospheric polychlorinated biphenyls.** *Bull. Environ. Contam. Toxicol. 11(5): 442-450; 1974.* (10 references)

An efficient collection system for PCB vapors which allows hundreds of cubic meters of air to be sampled per day is described. The trap is a plug of porous polyurethane foam. Following sampling the plugs were extracted in soxhlet extractors with petroleum ether. The extracts were then concentrated by evaporation and cleaned up by alumina or silicic acid column chromatography. The extracts were analyzed via gas chromatography. Alumina chromatography removed two major GC peaks which appeared to come from the foam plugs themselves. The plugs gave excellent collection efficiency for tri-, tetra-, and pentachlorobiphenyl isomers. Glass fiber filters are commonly used to collect high-volume particulate samples and are efficient collectors of DDT dusts and some organophosphorus insecticide vapors under low-flow conditions; under high-volume sampling they are poor collectors for PCB vapors. Preliminary experiments indicate that foam plugs are good collectors for both PCBs and atmospheric DDT under high-volume sampling conditions.

74-2502. Gothe, R. (Wallenberglaboratoriet, Stockholm Univ., Stockholm, Sweden). **Oxidation with tetrabutylammonium permanganate for quantitation of DDT residues in GLC determination of chlorinated hydrocarbons.** *Bull. Environ. Contam. Toxicol. 11(5): 451-455; 1974.* (13 references)

A method for the single step conversion of DDT, DDE, DDD (TDE), and DDT derived compounds to dibutyl phthalate (DBP) is described. The DBP can then by analyzed by GLC to determine the total content of neutral DDT metabolites. The method takes advantage of the facile ion pair extraction of permanganate ion from water to low polar solvents observed on addition of lipophilic ions such as tetrabutyl-ammonium ion. The two-phase reagent also contains sodium periodate and sodium hydroxide. Anisole is used as a high boiling solvent. The recovery of DBP from DDT, DDE, and DDD at levels corresponding to 0.2, 2.0, and 20 g DDE, respectively, was quantitative. The less reactive *o,p'*-DDT required a modified addition of reagents for quantitative recovery of *o,p'*-DBP. This procedure will also serve to simplify the determination of PCB compounds by eliminating interfering peaks.

74-2503. Callmer, K.; Nilsson, O. (Dept. Technical Analytical Chem., Chem. Ctr., Lund, Sweden). **Modification of a Varian liquid chromatography UV-detector for high sensitivity measurements.** *Chromatographia 6(12): 517-518; 1973.* (2 references)

The UV-detector used in the Varian 4100 liquid chromatograph is highly sensitive for the detection of compounds absorbing at 254 nm, but its use is limited at high sensitivity. The detector stability was greatly increased by: replacing the polyethylene foil gaskets between the silica lenses and the cell with viton foils and the use of a slow nitrogen flow through the reference cell to prevent solvent leakage; the replacement of the bakelite cell holder with a brass replica containing cooling coils to keep the temperature of the detector constant; and the insertion of an electrical RC-filter at the output of the detector to eliminate high frequency noise. These modifications decreased the long range drift from about 0.008 to 0.0002 absorbance units (AU) per hour and the noise level from 0.002 to 0.0002 AU at a flow of 80 cm^3 isooctane per hour. The lower limit for the detection of biphenyl was decreased from 10 ng to 0.4 ng, the detector response being linear from 0.4 up to at least 1000 ng of biphenyl.

74-2504. Done, A. K. (Author address not given). **The toxic emergency: spot and on-the-spot tests.** *Emergency Med. 6(7): 154-160; 1974.*

One or more of the following three tests may be used "on the spot" to determine organophosphate poisoning. To test for parathion poisoning, measure *para*-nitrophenol in urine (chronic) or stomach contents (acute). To 10 ml collected by steam-distillation of the sample, add 2 NaOH pellets. A yellow color is positive. No sign of atropine effect within 10-15 min after a test dose of atropine (1 mg IM or IV for adult; one-quarter of this amount for a small child) is a positive sign of organophosphate poisoning. Plasma cholinesterase may be measured by conventional method or as follows: dip filter paper in fresh 0.05% bromthymol blue solution containing acetylcholine bromide, 100 mg per ml and dry in air. Divide into three pieces and to one apply 2 drops of any pH 5 buffer (control), to the second 2 drops of cell-free plasma from the patient (unknown), and to the third plasma from a healthy person (control). If the unknown takes at least twice as long as both controls to turn from blue to yellow, this is a positive sign of depressed cholinesterase activity.

74-2505. Ruzicka, J. H. (Lab. Government Chemist, London, England). **Methods and problems in analysing for pesticide residues in the environment.** *IN: Environmental Pollution by Pesticides. Plenum Press, London, 1973, p. 11-56.* (268 references)

The stages of pesticide residue analysis include: residue extraction; removal of interfering substances; estimation of the quantity of pesticide residues, meta-

bolites, and breakdown products in the cleaned-up extract; confirmation of the presence of the residue by using a different method or by forming a derivative. Basic methods of analysis include functional group analysis, biological testing, chromatography, spectroscopy, and radiochemistry. Methods for bioassaying pesticide residues can be classified as dry methods, wet methods, diet methods, and enzymatic methods. Spectrophotometric determination includes ultraviolet and visible, infrared, and fluorescence and phosphorescence techniques. Chromatographic methods include paper, thin-layer, gas-liquid, and liquid-liquid chromatography. Recent progress has been made in the application of computers to determine low levels of pesticide residue. Fumigants and fungicides are used for the protection of stored foods, particularly cereals. Methods of determination of multiple residues of organic fumigants are presented. Problems involved in residue analysis include loss of the pesticide due to breakdown or volatilization, presence of interfering compounds, solvent and reagent contamination and establishing positive identification of the pesticides present in a sample.

74-2506. Widmark, G. (Inst. Anal. Chem., Univ. Stockholm, Stockholm, Sweden). **Modern trends of analytical chemistry as regards environmental chemicals.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 78-85.*

Due to immense improvements in the area of analytical detectors, analytical schemes not requiring steps of separation will find expanded use in the future of analytical chemistry in regard to pesticides existing in the environment. Non-destructive analyses are increasing markedly in importance, especially in studies at heterogeneous surfaces when using scanning devices of high precision. Rapid methods of analysis are being developed to permit more elements to be detected simultaneously. There is a great need for further improvement in the area of detector sensitivity. These improvements must also cover the entire analytical system, not only the detector. For example, the electron multiplier tube is already capable of detecting almost single ions when the detector operates under high vacuum, but the tedious evaluation of the data recorded hampers general use in residue analysis, and considerable losses prior to detection occur in the mass spectrometer. Computers are becoming useful in the areas of data handling and selection.

74-2507. Sunahara, H.; Goto, M.; Korte, F. (Dept. Anal. Chem., Government Ind. Res. Inst., Nagoya, Japan). **Possibilities and problems of automatic measurements of environmental chemicals.** *IN: Environmental Quality and Safety, Volume 1. Georg Thieme Verlag/Academic Press, Stuttgart/New York, 1972, p. 189-209.* (43 references)

Pesticides in air, water, and soil must be monitored to maintain the balance of nature. Except for the chlorinated hydrocarbons, most types of pesticides decompose rapidly enough in the soil so that the original residues disappear between crop seasons. Major factors determining persistence are nature of the chemical, soil type, soil moisture, soil temperature, wind or air movements, cover crops, soil cultivation, method of application, formulation, and soil microorganisms. Analytical chemistry processes used to maintain environmental quality include sampling systems, treatment systems, detection and determination systems, and data systems. Coulometry and gas chromatography have been used to achieve automatic measurement of air quality. Measurement of water quality is difficult because residues are usually considered in the range of parts per billion or parts per trillion by weight. Pesticide residues in water can be considered as an adsorbed form on solid particles, a dissolved form in fatty substances, an associated form with organic materials, or an associated form in fatty substances. Coulometry, gas chromatography, and electrolytic conductivity methods have been used to analyze water quality in relation to pesticide content.

74-2508. Beroza, M.; Bowman, M. C. (USDA, ARS, Beltsville, MD 20705). **Some recent developments in the chromatographic determination of multicomponent pesticide residues.** *IN: International Symposium on Identification and Measurement of Environmental Pollutants. Campbell Printing, Ottawa, 1971, pp. 216-223.* (69 references)

The gas chromatographic determination of pesticide residues has been speeded up and the reliability increased through use of highly specific detectors for phosphorus-containing pesticides. A multicomponent analysis has been devised for the determination of residues of phosphorus- and sulfur-containing pesticides in environmental samples. It features exhaustive extraction, minimum clean-up, flame photometric detection for high specificity and sensitivity of response, temperature programming for determination of residues with a wide variety of retention times, and packings with liquid phases of high thermal stability on supports of low reactivity and adsorptivity. The thermal stability of one of the liquid phases allows the packing to be cleaned at high temperatures when interference from the injection of many unclean samples becomes excessive. Quantitative thin-layer chromatography by direct photometric measurement of developed spots also offers promise in pesticide residue analysis. A review of the performance of three flame photometric detectors for halogen compounds is given.

74-2509. McCully, K. A.; McLeod, H. A. (Res. Labs., Food and Drug Directorate, Dept. Nat. Health Welfare, Ottawa, Canada). **Methodology for the determination of multipesticide residues in foods.** *IN: International*

Symposium on Identification and Measurement of Environmental Pollutants. Campbell Printing, Ottawa, 1971, pp. 224-232. (103 references)

The determination of the large number and variety of pesticide residues which may occur in or on foods for human consumption requires a systematic approach. Several methods or combinations of methods are necessary. Each of the major multipesticide residue methods, including procedures for sampling, extraction, cleanup, determination, and confirmation, has its own scope and ability to produce reliable and meaningful residue data. Most multipesticide residue methods determine organochlorine and/or organophosphorus compounds and some of their metabolites, but other metabolites are either not determined or the methods have not been evaluated for these compounds. Methods for determining pesticides such as carbamates, herbicides, and fumigants are not as well developed. Present methods must be integrated and expanded to include more compounds and metabolites. Future research should include studies of extraction of residues from samples, cleanup, multidetection systems, confirmation procedures, data acquisition, and interpretation systems.

74-2510. Holden, A. V. (Freshwater Fisheries Lab., Perthshire, Scotland). **The analysis of fish for organochlorine residues.** *IN: International Symposium on Identification and Measurement of Environmental Pollutants, Campbell Printing, Ottawa, 1971, pp. 233-238.* (31 references)

Organochlorine residues found in fish include several pesticides and their degradation products, polychlorinated biphenyls, and aliphatic chlorinated hydrocarbons. All are fat-soluble and extractable by appropriate solvents, but separation from fats is essential before analysis. The most commonly used method of identification and determination is electron capture GLC, but the large number of compounds present in some samples necessitates a pre-GLC separation into groups, particularly if polychlorinated biphenyls are present. Mass spectrometry and other techniques can assist in the identification of unknown substances detected by GLC. Polar chlorinated compounds, including chlorinated phenols and phenoxy-acids, and also some pesticide metabolites, require conversion to ethers or esters before detection by GLC. The accuracy of the methods available is not high, but is generally adequate for monitoring pesticides. The quantitative estimation of polychlorinated biphenyls is only very approximate.

74-2511. Hankin, L. (Conn. Agr. Exp. Sta., P.O. Box 1106, New Haven, CT 06504). **Report on enzymes.** *J. Ass. Offic. Anal. Chem. 56(2): 272-273; 1973.*

The recommendations of the AOAC regarding various enzyme methods are given. A review on enzyme inhibition methods for pesticide residues has been published. A thin-layer chromatographic-enzyme inhibition technique has been used to detect 0.01 ppm methomyl in oils and meals and 0.03 ppm in seeds. Gas liquid chromatography has also been used to measure residues in food extracts or TLC inhibition zones, with a detection limit of about 0.05 ppm in oils.

74-2512. Frei, R. W.; Lawrence, J. F. (Anal. Res. Develop., Pharm. Dept., Sandoz Ltd., 4002 Basel, Switzerland). **Fluorigenic labelling in high-speed liquid chromatography.** *J. Chromatogr. 83(1): 321-330; 1973.* (22 references)

Fluorigenic labeling techniques have been used for several years in conjunction with thin-layer chromatography, and are now being used also to good advantage in high-speed liquid chromatography. In this work, reagents such as 4-chloro-7-nitrobenzo-2,1,3-oxadiazole, dansyl chloride, and dansyl-hydrazine were used for the fluorigenic labeling of carbamates, ureas, organophosphorus compounds, aliphatic amines, aldehydes, ketones, biphenyls and some compounds of pharmaceutical interest. The labeling reactions and the nature of derivatives are discussed, together with the column liquid chromatographic properties of these derivatives in both liquid-liquid and solid-liquid modes. Detection limits obtained for most compounds with a new fluorimetric detection device range between 1 and 10 ng per 4-μl injection volume. The method is suitable for quantitative analysis, with a reproducibility of ca. 3% relative standard deviation. Linear calibration plots for peak area or peak height versus concentration were observed up to 600 ng per injection. The method has been applied successfully to the environmental sample analysis of pesticides in water, soil and vegetables without the necessity for a preliminary clean-up. The method is comparable in sensitivity and accuracy to gas chromatography. The advantages of this method can be summarized as follows: improved detection properties, such as better sensitivity, flow-insensitive detection mode and higher specificity; lowering of polarity of the compounds, hence greater ease of separation; suitable for automation and routine analysis; the range of possible applications is limited only by the available labeling reagents and separation procedures. (Author abstract by permission)

74-2513. Eisenbeiss, F.; Sieper, H. (E. Merck, Darmstadt, Germany). **The potential use of high-performance liquid chromatography in residue analysis.** *J. Chromatogr. 83(1): 439-446; 1973.* (2 references)

High-performance liquid chromatography is introduced as a new procedure for the determination of pesticides or pharmaceutically active ingredients in plant or animal materials. The most important factors influencing the efficiency of a residue method, e.g. detection limit, reproducibility and linearity, are comparable to those of gas chromatography, if suitable column packings and sensitive detectors are used. Moreover, liquid chromato-

graphy has the advantage that less volatile substances and substances that decompose rapidly at high temperatures can be detected. The exact identification of residues using more than a single analytical method will become more important in the future. Thus, liquid chromatography can also find its place in "confirmatory analysis". The results of experimental investigations with pesticides confirm that high-performance liquid chromatography can be regarded as an alternative or a supplementary method to conventional methods such as gas chromatography. (Author abstract by permission)

74-2514. Anonymous. **Thin-layer chromatography.** *J. Chromatogr. 85(Suppl): B374-B378; 1973.* (155 references)

This bibliography contains references to reviews and books and to articles on fundamentals, techniques, hydrocarbons, and halogenated hydrocarbons including polychlorinated biphenyls, alcohols, phenols, oxo compounds, carbohydrates, organic acids and simple esters, lipids and their constituents. Steroids, terpenes and other volatile aromatic compounds, amino acids, organometallic and related compounds, vitamins and growth factors, antibiotics, insecticides and other pesticides, synthetic and natural dyes, plastics and their intermediates are also discussed, as are synthetic drugs and systematic analysis, toxicological applications of drug metabolism, plant extracts, inorganic substances, radioactive and other isotope compounds, sodium dodecyl sulfate and cationic surfactants. The pesticide section contains articles on pyrethrins, organophosphorus sheep dip, carbaryl, TLC-enzyme inhibition techniques, and organochlorines.

74-2515. Anonymous. **Gas chromatography.** *J. Chromatogr. 85(Suppl.): B400-B405; 1973.* (86 references)

This bibliography on gas chromatography (GC) contains titles of reviews, books, and articles on fundamentals, detectors, column performance and filling studies, apparatus, accessories and materials, preparative scale GC, special microtechniques and functional analysis, automation, measurement of physico-chemical and related values, hydrocarbon types other than gaseous, halogen derivatives of hydrocarbons, alcohols, oxo compounds, carbohydrates (structural studies), organic acids and simple esters, lipids and their constituents, steroids, nitro and nitroso compounds, amides, amines and related nitrogen compounds, amino acids, purines, pyrimidines, nucleic acids and their constituents, sulfides of gasoline-petroleum distillate, inorganic mercury (low concentrations), thiamine and derivatives, tocopherols and tocotrienols in vegetable oils, antibiotics, insecticides and other pesticides, plastics and their intermediates, synthetic drugs and systematic analysis, toxicological applications of drug metabolism, carbon monoxide, volatile inorganic substances, radioactive and other isotopic compounds, antioxidants and preservatives and cigarette smoke. The pesticide section has references on analysis of hexachlorophene, ring-substituted furfural diethylacetal derivatives, carbamates and polychlorinated dithiocarbamates.

74-2516. Hastings, C. R.; Aue, W. A. (Environmental Trace Substances Cent., Univ. Missouri, Columbia, MO 65201). **Novel, polymer-deactivated adsorbents as supports in gas-liquid chromatography.** *J. Chromatogr. 89(2): 369-373; 1974.* (2 references)

Supports of Carbowax 20M-modified Celite 545 were covered with 1%, 3%, and 10% loads of Apiezon L and OV-210. Controls were similar columns without Carbowax modification. Columns of bare and modified Celite were conditioned overnight at 210° following a 5 μl injection of test mixture containing 100 pg/μl each of aldrin, heptachlor epoxide and dieldrin, 200 pg/μl of endrin and 300 pg/μl of *p,p'*-DDT. A Mikrotek 220 gas chromatograph was used with 6 ft by 4 mm ID pyrex U-tube columns. The effluent was routed to a ^{63}Ni electron capture detector with a nitrogen flow rate of approximately 80 ml/min. The desired deactivation effect was clearly observed on 1, 3, and 10% Apiezon L and OV-210 with modified Celite, and the differences between bare and modified supports became less pronounced as load and/or polarity of the liqud phases increased. Solute retention takes place primarily in the bulk liquid phase, rather than in the Carbowax film. Separation patterns of a mixture of 30-60 pg each of lindane, heptachlor, heptachlor epoxide, and aldrin on Carbowax 20M-modified Celite, 3% OV-101 on Carbowax 20M-modified Celite and 3% OV-101 on bare Celite demonstrated that the presence of the polymer did not significantly influence the separation pattern prescribed by the liquid phase.

74-2517. De Vos, R. H.; Bosma, M. P. M. M.; Brouwer, A. E. (Cent. Inst. Nutr. Food Res. TNO, Zeist, The Netherlands). **Rapid analysis of dichloran, lindane, PCNB and TCNB residues in lettuce by automated gas-liquid chromatography.** *J. Chromatogr. 93(1): 91-98; 1974.* (3 references)

Residues of the pesticides dichloran (2,6-dichloro-4-nitroaniline), lindane, PCNB (quintozene) and TCNB (tecnazene) are extracted from lettuce samples with ethyl acetate. An internal standard is added. The extracts obtained are diluted with *n*-hexane and analyzed by automated gas-liquid chromatography with electron capture detection. Chromatographic data are processed on a programmable desk-top calculator. A program has been developed for this purpose that can also be applied to other multi-component residue analyses. The system is suitable for screening large series of samples. The accuracy of the analysis is at least as good as can be obtained with manual analysis. (Author abstract by permission)

74-2518. Fishbein, L. (Nat. Center for Toxicol. Res., Jefferson, AR 72079). **Chromatographic and biological aspects of DDT and its metabolites.** *J. Chromatogr. 98(1): 177-251; 1974.* (254 references)

The column, thin-layer, gas-liquid and liquid chromatographic, the combined liquid and gas-liquid chromatographic-mass spectroscopic techniques, as well as the biological and toxicological aspects of DDT and its metabolites have been reviewed. Primary focus was placed on their utility, ecological distribution, and toxicity, as well as diverse techniques for their separation from polychlorinated biphenyls and other chlorinated pesticides and subsequent analysis. (Author abstract by permission)

74-2519. Lawrence, J. F.; Frei, R. W. (Food Res. Labs., Health Protect. Branch, Tunney's Pasture, Ottawa, Canada). **Fluorimetric derivatization for pesticide residue analysis.** *J. Chromatogr. 98(1): 253-270; 1974.* (163 references)

Recent developments in fluorescence reactions for trace analysis are reviewed. A section on fluorescence analysis includes discussions of fluorescence theory, analytical considerations, and factors affecting fluorescence, including structural, solvent, and concentration effects. The analysis of pesticides is considered in terms of hydrolysis, ligand-exchange reactions, pH effects, polarity, heat treatment, and condensation reactions. Also considered are reactions of dansyl chloride with *N*-methylcarbamate insecticides, *N*-phenylcarbamate and urea herbicides, organophosphate insecticides, *s*-triazine herbicides, and hydroxybiphenyls. The final sections cover reactions of NBD chloride with pesticides, reactions of fluorescamine, and fluorigenic labeling in solution and TLC and HSLC analysis.

74-2520. Handa, Y. P.; Bains, I. S.; Chabal, D. S.; Chopra, S. L. (Dept. Chem. Biochem., Punjab Agr. Univ., Ludhiana, India). **Microdetermination of residues of Lasso (2-chloro-2′,6′-diethyl *N*-methoxymethyl acetanilide).** *J. Indian Chem. Soc. 50(5): 333-334; 1973.* (1 reference)

A method for the microdetermination of the residues and degradation products of alachlor was devised. A few μl of alachlor solution was ignited in a Schoniger flask in the presence of excess oxygen, after which the products were absorbed in a mixture containing 0.1 *N* NaOH and 3% H_2O_2. This solution was then titrated potentiometrically with 10^{-4} *N* $AgNO_3$. The degradation products of alachlor were separated and identified and determined by thin-layer chromatography. The minimum amount of this compound which can be determined by this method is 1 ppm, although the volume taken for combustion should contain at least 10 μg of alachlor.

74-2521. Cooke, B. K. (Spray Application Sect., Long Ashton Res. Sta., Univ. Bristol, Bristol BS18 9AF, England). **Procedures for analysis of surface spray deposits of captafol on coffee trees, captan on apple trees and endosulfan on hops by gas-liquid chromatography.** *Pestic. Sci. 4(5): 683-687; 1973.* (13 references)

The procedures involve the removal of captafol, captan or endosulfan spray deposits from the plant surfaces with solvent and their measurement by glc. In contrast to residue analysis, clean-up procedures are avoided and the speed of the methods enable large numbers of samples to be processed in the monitoring of initial spray deposits and the subsequent redistribution or loss in relation to the efficiency of spray application techniques. Recoveries of captafol and captan suspension deposits from glass were greater than 96%; recoveries of emulsion deposits from plant surfaces were greater than 95% for captafol, 93% for captan and 96% for endosulfan. (Author abstract by permission)

74-2522. International Atomic Energy Agency (Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, Vienna, Austria). **Radiotracer studies of chemical residues in food and agriculture.** *International Atomic Energy Agency, Vienna, 1972, 166p.*

Proceedings of a combined panel and research corrdination meeting organized by the joint FAO/IAEA Division of Atomic Energy in Food and Agriculture are presented. Abstracts of most papers appear, some concerned with mercury and cadmium as environmental pollutants and a simple method for the activation analysis of mercury in fish. A report of the meeting discusses the value of tracer techniques (including the use of stable isotopically-labeled compounds) for obtaining information on persistence and fate of foreign substances in organisms and the environment, the importance of training in the use of nuclear techniques particularly in the developing countries, the need for improved techniques (particularly neutron activation analysis) for the identification and assay of labeled fractions resolved by gas-liquid and thin-layer chromatography, the need for better supplies, distribution and information on isotopically-labeled compounds, the establishment of status summary sheets for dissemination of authoritative basic information on the nature of chemical residues and outstanding pesticide and other chemical residue problems.

74-2523. Kokke, R. (Lab. of Microbiol., Delft Univ. of Technol., Delft, The Netherlands). **Radioisotopes applied to environmental toxicity research with microbes.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture, International Atomic Energy Agency, Vienna, 1972, p. 15-23.* (14 references)

Microbes which accumulate pesticide residues in the soil or water may be detected by autoradiography using water or soil samples streaked onto nutrient agar containing the radiolabeled pollutants. The amount of

radioactivity accumulated by different colonies may be estimated by the intensity of the corresponding black spots on the autoradiogram, and the proportion of pollutant-accumulating microbes in a population can also be estimated. Using stripping film techniques, accumulations may be demonstrated in single cells. It was found that, in addition to accumulating in the cells, DDT crystals were sometimes present in the precipitates in liquid medium experiments. Uptake of DDT by baker's yeast, soil, waste water, or nutrient broth was studied using ^{14}C-DDT and measuring the amount of unchanged labeled compound left in the medium. The uptake of DDT by baker's yeast paralleled growth.

74-2524. Disney, R. W.; Fowler, K. S. (Min. of Agr., Fisheries and Food, Pest Infestation Control Laboratory, Slough, Buckinghamshire, England). **The possibility of isotope exchange or other interfering reactions occurring during the determination of residues from fumigation with ^{32}P-labelled phosphine.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 87-88.* (2 references)

The results from parallel chemical and radiometric methods indicated that no measurable isotope exchange occurred up to 14 days after fumigation of whole Manitoba wheat with ^{32}P-phosphine using a fumigation mixture of phosphine in air at 5 mg/l. at 25°. The activity of the labeled phosphine was 15 μCi/mg.

74-2525. Robinson, J. R. (Canada Department of Agriculture, Research Institute, London, Ontario, Canada). **Phosphorus residues from ^{32}P-phosphine: an artifact?** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture, International Atomic Energy Agency, Vienna, 1972, p. 89-91.* (9 references)

The author answers the argument that ^{32}P-phosphine behaves differently from the unlabeled commercial product due to self-radiation and nuclear decay and the possibility of isotopic exchange, and that, therefore the existence of non-volatile phosphorus residues found with ^{32}P-phosphine is "not proven" for the unlabeled product. Neutron activation analysis using non-labeled phosphine on a phosphorus-free substrate (ultra-pure filter paper) was used to show the presence of phosphorus-containing residues. When the ultra-pure filter paper was exposed to ^{32}P-phosphine, the non-volatile phosphorus residues were of the same order of magnitude as with the unlabeled product.

74-2526. Robinson, J. R. (Canada Department of Agriculture, Research Institute, London, Ontario, Canada). **Hydrogen phosphide residues in cereals: a discussion of key-problems indicating the need for use of nuclear techniques.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 93-97.* (13 references)

Tests are now available for the recovery and determination of residual gaseous phosphine with reliability in the nanogram/gram range without the use of radioactive isotopes. However, high background of naturally occurring phosphorus overwhelmingly masks non-volatile phosphorus residues. The author suggests two possible approaches to deal with this problem. For research purposes, pure aluminum phosphide-^{32}P should be used on field scale experiments. Volatile residues could be determined both radiometrically and chemically, and non-volatile residues could be assayed by counting. For routine inspections, test-strips of a suitable, phosphorus-free matrix material should be placed in strategic positions throughout the place to be fumigated. After exposure these zero-blank test-strips should be subjected to neutron activation analysis for phosphorus.

74-2527. Lubkowitz, J. A. (Dept. Tecnol. Nuclear, Inst. Venezolano Invest. Cientif., Caracas, Venezuela). **Detection of labelled fractions from GLC columns.** *IN: Radiotracer Studies of Chemical Residues in Food and Agriculture. International Atomic Energy Agency, Vienna, 1972, p. 129-135.* (9 references)

A system for counting labeled fractions emerging from gas-liquid chromatography columns must account for the quenching of labeled compounds as they pass the detector or must account for the case of a labeled compound entering the detector in conjunction with an unlabeled fraction. A 4-detector system was used in which 2 of the detectors determine the efficiency since one of them contains a standard ^{14}C source. These detectors reduce background since they are used in anti-coincidence with their respective analytical detector. Accumulated counts obtained with both detectors permit efficiency corrections. Though the system can be contaminated by previous injections, this can be corrected by flushing the detector for 30 seconds with oxygen. Both labeled and non-labeled compounds can be detected. The detection limit for a residue is 50 ppm if the labeled pesticide has a specific activity of 1 m Ci/m*M*.

74-2528. Leoni, V.; D'Alessandro DeLuca, E.; Simeone, A. M. (Ist. Ig. "G. Sanarelli", Univ. Roma, Rome, Italy). **Tecniche per la ricerca quali-quantitativa dei policlorodifenili nei prodotti alimentari e negli imballaggi. [Technique for qualitative-quantitative detection of PCB in food products wrapping..]** *Rass. Chim. 25(2): 99-111; 1973.* (8 references) (Italian)

PCBs are widely used; the resulting contamination of animals,. foods, water, and environment is very common. An accurate method for detection of PCBs was required, and after studying the chemico-physical properties, it was determined that the best method for

detection was chromatography. The determination of residues of organochlorine pesticides in food was also done using gas chromatography with a detection limit of about 0.5 ppb. If PCBs are mixed with the products, the sensitivity is lower. For a more accurate detection PCBs must be isolated from the other compounds and then the pesticides determined quantitatively.

74-2529. Usmentseva, A. Z.; Zagorul'ko, A. Ya.; Vas'kovskaya, L. F. (Inst. Zool., Acad. Sci. Ukr. SSR, USSR). **Opredeleniye khlororganicheskikh pestitsidov v sakhara metodom tonkosloynoy khromatografii. [TLC determination of organochlorine pesticides in sugar.]** *Sakh. Prom. 5: 43-45; 1974.* (7 references) (Russian)

A simple, high-sensitivity thin-layer chromatographic method is described for the identification and quantitative determination of heptachlor, lindane, DDT, DDD (TDE), and DDE residues in sugar. Following extraction from aqueous solution by means of *n*-hexane repeated three times, the extract is purified by means of sulfuric acid-saturated anhydrous sodium sulfate or on an alumina column. The cleaned sample is transferred to an alumina layer and exposed to solvent vapors, after which visualization is done by means of ammoniacal solution of silver nitrate in acetone and subsequent UV irradiation. The individual pesticides are identified by their respective *Rf* values, and quantitative determination is possible by comparison of the size and color intensity of the spots. The rates of recovery were determined to be 95.8% for DDT, 91.4% for lindane, and 95.5% for heptachlor.

74-2530. Stadnichenko, E. I.; Volkova, Ye. A. (Dept. Toxicol. Chem., Kharkov Inst. Pharmaceutics, Kharkov, USSR). **Opredeleniye trikhlormetafosa pri khimiko-toksikologicheskikh issledovaniyakh. [Determination of trichlorometaphos during chemical-toxicological studies.]** *Sud. Med. Ekspert. 16(4): 37-39; 1973.* (Russian)

A method for the extraction, clean-up, and qualitative and quantitative determination of trichlorometaphos (ronnel) in animal and human liver samples is described. Following extraction with acetone, the extract is partitioned into acetonitrile, after which the cleaned-up sample is transferred onto chromatographic paper in a 1:1:2 ratio of alcohol-acetone-water. For identification, half of the chromatogram is sprayed with sodium hydroxide in ethanol, acetone solution of 4-aminoantipyrine, and aqueous solution of potassium ferricyanide. The other half of the chromatogram is treated with ammonium persulfate, *m*-nitrophenol, sodium hydroxide solution and sulfuric acid, after which ammonium molybdate, hydrazine sulfate, and tin chloride are added for colorimetric quantitative determination. The sensitivity of the method averaged to 2 mg in 50 liver samples, the recovery rate ranging from 87 to 92%.

74-2531. Gnaegi, F.; Mestres, R.; Tourte, J.; Campo, M. (Station Federale de Recherches agronomiques de Lausanne, Lausanne, Switzerland). **Dosage des residus de fongicides a noyau benzimidazole et des thiophanates dans les raisins, les jus de raisin et les vins et, en general, dans les fruits et legumes. [Determination of benzimidazole-derived and thiophanate fungicides in grapes, grape juice, wine, and fruits and vegetables in general.]** *Trav. Soc. Pharm. Montpellier 34(1): 91-100; 1974.* (6 references) (French)

A previously described method for the determination of thiabendazole and benomyl residues in citrus fruits and other fruits and vegetables is adapted for the determination of benzimidazole and thiophanate fungicides in grapes, grape juice, and other fruits and vegetables. Following extraction by means of ethylacetate in ammoniacal solution, the extract is cleaned up by twofold passage in acidic aqueous phase, after which determination is done by UV spectrophotometric analysis of the methyl or ethyl benzimidazole carbamate formed from benzimidazole-derived fungicides. In the case of thiophanates, the formation of methyl or ethyl benzimidazole carbamate requires either direct cyclization in the presence of dimethylformamide without the usual clean-up procedure, or, as in the case of strong absorption bands below 250 nm, a complementary purification by the addition of a mixture of sodium acetate, sodium chloride, and sodium hydroxide prior to the usual clean-up procedure.

See also 74-2344

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